



EVALUATION OF THE QUEUE SYSTEM OF A DRIVING LICENSE APPLICATION AT KEPOLISIAN SUMBAWA BESAR

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ABSTRACT

Article History:

Received: 31st October 2022

Revised: 29th December 2022

Accepted: 5th February 2023

Keywords:

Driving license;

The queuing system;

Queue theory;

Single Channel-Multi Phase

A driving License (SIM) is a card that a motorized vehicle driver must own to prove eligibility to drive a motorized vehicle. There are still many drivers who do not have a SIM. One of the reasons drivers don't apply for a driving license is because they object to follow every procedure in making a driver's license, which takes a long time and causes long queues every day. The application for a driver's license in a city or district is only in one place, namely at the City Police. As a result, many applicants apply for a driver's license in the queue system. This problem also occurs in the SIM-making service system at the Sumbawa Police Station. Therefore, this study aims to evaluate the queuing system for SIM-making services at the Sumbawa Besar Resort Police using the queuing theory method. There are two types of submissions in applying for a SIM, namely a new application and an application for an extension of a SIM, and the queuing system model used is the Single Channel-Multi Phase. There are three phases in applying for a new SIM: the registration phase, the photo phase, and test phase. Meanwhile, the application for a SIM extension has two steps: registration and photos. Based on the results of the analysis, the use of one service in each phase has not been optimal in overcoming the number of queues in the new SIM application process because there is still a steady-state (ρ) greater than one, and the number of applicants is still queuing in the system, namely on Monday (phase test), Wednesday (test phase) and Friday (photo phase and test phase). Therefore, it is proposed to add one more service on that day and phase so that the stadium condition (ρ) is less than one and there is only one applicant in the queue (L_q).



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How to cite this article:

K. Hermanto, E. Ruskartina, I. Adiasa, N. Hudaningsih, G. Royen and Harizahayu., "EVALUATION OF THE QUEUE SYSTEM OF A DRIVING LICENSE APPLICATION AT KEPOLISIAN SUMBAWA BESAR," *BAREKENG: J. Math. & App.*, vol. 17, iss. 1, pp. 0383-0390, March 2023.

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Journal homepage: <https://ojs3.unpatti.ac.id/index.php/barekeng/>

Journal e-mail: barekeng.math@yahoo.com; barekeng_journal@mail.unpatti.ac.id

Research Article • Open Access

1. INTRODUCTION

The growing population, including in Indonesia, requires people to develop a queuing culture, especially in places where people have crowded activities. Queues will occur if the demand for a service exceeds the available order [1]. Every company wants to fulfill customer satisfaction by providing the best service. One of the best services is not allowing customers to wait or queue too long by giving fast service [2]. Queues in everyday life often occur in public service places such as hospitals [3], supermarkets [4], and banks [5] and can not be separated from the site where the driver's license is made. A driving license is a letter that a motorized vehicle driver must own because it is proof that the person is fit to drive a vehicle. However, there are still many drivers who do not have a driving license. Drivers have various reasons for not having a driving license or not wanting to make a driving license. One of the reasons is that the driver does not wish to follow the procedure for making a driving license which is considered too long a process [6].

Based on 2020 data, the Sumbawa Samsat office is located at Jalan Bungur No. 4-A, the number of motorized vehicles for taxpayers is 77,900 [7]. Many motorized vehicles require vehicle owners to obtain a driving license. Making a driving license in a city or district is only in one place, namely at the city or district police, resulting in many customers waiting in line to make a driving license. It takes a long time from the beginning of the registration process until the applicant receives a driving license. Thus, making a driving license results in long waiting times for services. A large number of applicants and the slow service for issuing a driver's license cause queues to occur [8]. This problem also applies to the service system that produces a driving license at the Sumbawa Besar City Police Station. At the Sumbawa Police Station, applicants must fulfill several processes to obtain a driver's license. The stages of making a driving license include registration, filling out forms, payments, theoretical exams, practical exams, and photos until the driving license is completed and accepted by the applicant. Although the flow of the process of making a driving license looks simple, the process of making a driving license can sometimes take quite a long time, which can lead to queues. This problem can occur if the number of driving license applicants increases and is much greater than the number of resources provided in the service. It can cause queuing issues, and it is not easy to regulate the service process for making driving licenses [9].

The service department is usually in the form of counters operated by employees assigned to serve the community's needs. The community quickly criticizes this section because it is a visible part of the eyes of the community. Service counters are not necessarily just counters and employees but also include other factors such as the number of seats, employee performance, location settings, service hours, and others [10]. In the service of making a driving license, there are still some shortcomings, such as people who appear to be queuing, do not get a seat when queuing complains because the time for blinding a driving license is long, as well as many intermediaries or brokers in making it easier for people to make a driving license without following the queue. Implemented by the Resort Police of Sumbawa Besar and so on. These factors are what the public pays attention to in assessing the quality of an agency, and these factors need to be considered in developing public services, especially in the service counter queuing system.

Based on observations made in making a driving license at the Sumbawa Besar City Police, there are an unbalanced number of customers with available services, causing long waiting times to get a driving license. One way to analyze the problems in a queue is to evaluate the queuing system that has been applied so far, namely the multi-channel multi-phase queue. Therefore, the evaluation analysis was conducted to calculate how long the customer will spend and determine the adequacy of the number of services in making a driving license at the Sumbawa Besar City Police Resort.

2. RESEARCH METHODS

The data used are primary data obtained from direct observations of applicants for a driving license at the Sumbawa Besar Resort Police. Statements were made during working hours for five days, namely Monday 6 December 2021 to Friday 10 December 2021. This observation was carried out at one-hour intervals from 08.00-16.00 WITA in the queue room, so that data on the number of arrivals of driving license applicants were obtained. The data obtained from the observations are the number of arrivals and the length of service of the applicant in each phrase per minute and the time of service of the applicant. The data were tested for data adequacy using Equation (1) [11], where the data is said to be sufficient if the number of observation samples is less than the required number of samples ($N' < N$) [12].

$$N' = \left[\frac{\frac{k}{s} \sqrt{N \sum_{i=1}^n x_i^2 - (\sum_{i=1}^n x_i)^2}}{\sum_{i=1}^n x_i} \right]^2 \quad (1)$$

Where

- N' : The number of samples required.
- N : Number of observation samples.
- x_i : Observed sample ($i=1,2,3, \dots, n$).
- $\frac{k}{s}$: Comparison factor

On the arrival rate data and the service rate for driving license applicants, a distribution suitability test is carried out using SPSS software. Suppose the value of Asymp is obtained, sig is greater than the significance level value, then the arrival rate data has a Poisson distribution, and if the Asymp value is obtained. Sig is smaller than the significance level value, and the service level data is not exponentially distributed. In the queue system for a driving license application at the Sumbawa Besar City Police, there are more than one lane and more than one stage and applies a first-come-first-served (FCFS) transaction service system, where applicants who arrive first will receive service first.

In this study, the queue analysis for filing a driving license vote at the Sumbawa Besar Resort Police uses the generalized Poisson model. The following is a generalized Poisson model queue formula for multi-phase:

1. One server model [13]

Expected number of driving license applicants in the system:

$$L_s = \frac{\rho}{1-\rho} \quad (2)$$

Expectations of many driving license applicants in the queue:

$$L_q = \frac{\rho^2}{1-\rho} \quad (3)$$

Expected time to apply for a driver's license in the system:

$$W_s = \frac{1}{(\mu-\lambda)} \quad (4)$$

Expected time to apply for a driver's license in the queue:

$$W_q = \frac{\rho}{\mu(1-\rho)} \quad (5)$$

2. Multiple-server model [14]

Chances of no applicant in queue:

$$p_0 = \frac{1}{\sum_{n=0}^{c-1} \frac{\rho^n}{n!} + \frac{\rho^c}{c!} \left(\frac{1}{1-\frac{\rho}{c}} \right)}, \frac{\rho}{c} < 1 \quad (6)$$

Expected number of driving license applicants in the system:

$$L_s = \frac{\rho^{c+1} p_0}{(c-1)!(c-\rho)^2} + \rho \quad (7)$$

Expectations of many driving license applicants in the queue:

$$L_q = \frac{\rho^{c+1} p_0}{(c-1)!(c-\rho)^2} \quad (8)$$

Expected time to apply for a driver's license in the system:

$$W_s = \frac{\rho^c p_0}{(c-1)!(c-\rho)^2 \mu} + \frac{1}{\mu} \quad (9)$$

Expected time to apply for a driver's license in the queue:

$$W_q = \frac{\rho^c p_0}{(c-1)!(c-\rho)^2 \mu} \quad (10)$$

Where

c : Number of services available

λ : Average arrival of applicants (1/(average number of customers arriving in each queue in a system in one hour))

μ : Average transaction service (1/(average number of customers being served at a server per hour))

ρ : Steady State

P_0 : Probability that there is no applicant in the system

L_s : The predicted number of applicants in the system

W_s : Predicted waiting time in the system

L_q : The predicted number of applicants in the queue

W_q : Predicted waiting time in queue

3. RESULTS AND DISCUSSION

Based on observations that have been made for five days during the working day, namely on December 6-10, 2021 and for five hours of observation a day, namely at 08.00-13.00 WITA at the Sumbawa Besar City Police, the data recap of the number of driving license applicants (applicants for driving licenses) was obtained. new driving licenses and applications for renewal of driving licenses) and the average rate of service at the Sumbawa Besar City Police, respectively, are presented in **Table 1** and **Table 2**.

Table 1. Number of Arrivals for driving license applicants

Time	Monday (Applicant)	Tuesday (Applicant)	Wednesday (Applicant)	Thursday (Applicant)	Friday (Applicant)
08-00-09.00	2	10	10	7	8
09.00-10.00	5	6	10	5	3
10.00-11.00	4	7	5	9	12
11.00-12.00	11	10	6	6	10
12.00-13.00	10	8	20	11	17
Total	32	41	51	38	50

Table 2. Average Service Rate for Driving License Applications

Day	Type of Application for a Driving License				
	New Application			Extend Application	
	Registration (minute)	Photo (minute)	Test (minute)	Registration (minute)	Photo (minute)
Monday	5,66	6,72	9,54	5,05	7,18
Tuesday	5,46	7,50	9,31	5,26	7,54
Wednesday	5,40	7,40	9,40	5,36	7,38
Thursday	5,31	7,19	9,49	4,91	7,18
Friday	5,34	7,20	9,46	6,07	7,15

3.1. Data Sufficiency Test

Based on **Table 1**, it is possible to test the adequacy of the data used to evaluate the queuing system that the Sumbawa Besar City Police have implemented in providing driving license application services. Where it is known $\sum_{i=1}^{25} x_i = 212$; $\sum_{i=1}^n x_i^2 = 2194$; $\frac{k}{s} = 10$; and $N = 25$ by using **Equation (1)**, the value of $N' = 22$ is obtained. Therefore, it is obtained $N' < N$, and it can be concluded that the data of 212 applicants for a driving license for five days can be said to be sufficient for Analyzing the queue system for applying for a driving license at the Sumbawa Besar City Resort.

3.2. Distribution Fit Test

The type of arrival distribution and distribution of the service for submitting a driving license at the Sumbawa Besar City Police Resort can be determined using data from **Table 1** and **Table 2**. Therefore, based on the results of the distribution suitability test carried out using SPSS, the distribution type output is obtained as presented in **Table 3**.

Table 3. Distribution Fit Test

Data	Asymp. Sig	significant level	Decision
Arrival Rate	0,497	0,05	H ₀ accepted
Transaction Rate	0,073	0,05	H ₀ accepted

Based on **Table 3**, the arrival rate of applicants has a Poison distribution. Therefore, applicants' arrival is not affected by the arrival of applicants after or before. Meanwhile, the rate of application service is exponentially distributed; thus, the service form is constant from time to time [12].

The queue design for driving license applicants at the Sumbawa Besar City Resort is a single-channel multi-phase or three queues consisting of three stages that serve the process of submitting a driving license: list, photo and test. While the queuing discipline is that the applicant who arrives first will make the transaction first (First In, First Out), and the number of applicants who may enter is unlimited in the queuing system.

3.3. Queue System Performance Measure

Based on the data that has been collected for five days from 08.00-13.00 WITA at the Sumbawa Besar City Resort, which is presented in **Table 1** and **Table 2**, it can be determined the number of customers who come (λ), the number of transactions (μ) and the Steady state (ρ) New applications and applications for renewal of driving licenses are presented in **Table 4**. The new application for a driving license has three phases: the registration phase, the photo phase, and the test phase. Meanwhile, the application for an extension of a driving license consists of two phases, namely the registration phase and the photo phase.

Table 4. Steady State Analysis

Application	Day	Average	Registration		Photo		Test	
			Value	Steady State	Value	Steady State	Value	Steady State
New	Monday	Arrival Rate (λ)	4.00	0.37	4.00	0,45	4,00	0,64
		Transaction Rate (μ)	10.60		8.93		6,29	
	Tuesday	Arrival Rate (λ)	6.80	0.62	6.80	0,85	6,80	1,05
		Transaction Rate (μ)	11.00		8.00		6,45	
	Wednesday	Arrival Rate (λ)	7.20	0.65	7.20	0,89	7,20	1,13
		Transaction Rate (μ)	11.10		8.11		6,38	
	Thursday	Arrival Rate (λ)	5.60	0.50	5.60	0,67	5,60	0,89
		Transaction Rate (μ)	11.30		8.35		6,33	
	Friday	Arrival Rate (λ)	9.20	0.82	9.20	1,10	9,20	1,45
		Transaction Rate (μ)	11.24		8.33		6,34	
Extend	Monday	Arrival Rate (λ)	2.40	0.20	2.40	0,29	-	-
		Transaction Rate (μ)	11.88		8.35		-	
	Tuesday	Arrival Rate (λ)	1.40	0.12	1.40	0,18	-	-
		Transaction Rate (μ)	11.42		7.96		-	
	Wednesday	Arrival Rate (λ)	3.00	0.27	3.00	0,37	-	-
		Transaction Rate (μ)	11.19		8.13		-	
	Thursday	Arrival Rate (λ)	2.00	0.16	2.00	0,24	-	-
		Transaction Rate (μ)	12.21		8.35		-	
	Friday	Arrival Rate (λ)	0.80	0.08	0.80	0,10	-	-
		Transaction Rate (μ)	9.88		8.39		-	

Based on **Table 4**, it can be seen that there are several days and phases stating the average arrival rate of driving license applicants is greater than the average service rate of each, so it can be concluded that the density level (ρ) > 1 which means the queuing system is not in Steady-State conditions or it can be said that the queue system for applying for a driving license at the Sumbawa Besar City Police Resort is very dense or not optimal [15]. Therefore, an analysis of the queuing system model applied so far consists of one service using **Equation (2) - Equation (5)** presented in **Table 5**.

Table 5. Performance Measures of the Queue System for Application for a Driver's License

Application	Day	Phase	Ls (Applicant)	Lq (Applicant)	Ws (Hour)	Wq (Hour)
New	Monday	Registration	0.613	0.233	0.152	0.022
		Photo	0.818	0.368	0.203	0.028
		Test	1.778	1.138	0.437	0.037
	Tuesday	Registration	1.632	1.012	0.238	0.021
		Photo	5.667	4.817	0.500	0.016
		Test	-21.000	-22.050	-2.857	-0.008
	Wednesday	Registration	1.857	1.207	0.256	0.020
		Photo	8.091	7.201	0.398	0.012
		Test	-8.692	-9.822	-0.015	-0.023
	Thursday	Registration	1.000	0.500	0.490	0.022
		Photo	2.030	1.360	0.364	0.026
		Test	8.091	7.201	1.370	0.015
	Friday	Registration	4.556	3.736	0.490	0.013
		Photo	-11.000	-12.100	-1.149	-0.013
		Test	-3.222	-4.672	-0.350	-0.103
Extend	Monday	Registration	0.250	0.050	0.105	0.013
		Photo	0.408	0.118	0.168	0.025
	Tuesday	Registration	0.136	0.016	0.100	0.009
		Photo	0.220	0.040	0.152	0.019
	Wednesday	Registration	0.370	0.100	0.122	0.018
		Photo	0.587	0.217	0.195	0.029
	Thursday	Registration	0.190	0.030	0.098	0.011
		Photo	0.316	0.076	0.157	0.022
	Friday	Registration	0.087	0.007	0.110	0.007
		Photo	0.111	0.011	0.132	0.011

Based on the results of the queuing analysis in **Table 5** using one server (the queuing system that has been used so far), it is found that in the application for an extended driving license, there is no need to add a server because the results show that the number of applicants in the queue every day and in each phase is close to zero or can it say there are no applicants in the queue. While the new application for a driving license needs to be added to the number of servers in several phases [16], there are negative analysis results. There are still many driving license applicants queuing in the queue except Monday. In Table 6 below, the results of the simulation of the performance measurement of the queue system at the Sumbawa Resort Police are given by adding one server on a day, and the phase whose analysis results in table 5 are negative and which still has a large number of applicants in the queue using **Equation (6)**- **Equation (10)**.

Table 6. Performance Measures of the Queue Simulation of Application for a Driver's License

Application	Day	Phase	C	P ₀	Ls (Application)	Lq (Application)	Ws (Hour)	Wq (Hour)
New	Monday	Photo	1	0,623	0,613	0,233	0,152	0,022
		Test	1	0,552	0,818	0,368	0,203	0,028
		Registration	1	0,364	1,778	1,138	0,437	0,037
	Tuesday	Photo	1	0,382	1,632	1,012	0,238	0,021
		Test	2	0,372	1,024	0,173	0,151	0,025
		Registration	2	0,550	0,565	0,037	0,166	0,011
	Wednesday	Photo	1	0,352	1,857	1,207	0,256	0,020
		Test	2	0,355	1,088	0,201	0,151	0,028
		Registration	2	0,552	0,564	0,048	0,170	0,013

Application	Day	Phase	C	P ₀	L _s (Application)	L _q (Application)	W _s (Hour)	W _q (Hour)
	Thursday	Photo	1	0,505	1,000	0,500	0,490	0,022
		Test	1	0,667	2,030	1,360	0,364	0,026
		Registration	2	0,356	1,084	0,199	0,194	0,036
	Friday	Photo	2	0,387	0,970	0,152	0,105	0,017
		Test	2	0,534	0,595	0,043	0,129	0,009
		Registration	2	0,434	0,827	0,102	0,180	0,022

Based on **Table 6**, it can be seen that there is a significant change with the addition of the number of servers to two servers in a few days and the dense phase of the number of applicant queues. Besides, there is no longer a negative queue performance measure value because the queuing system has met a steady state. The results of the calculation analysis show that the average number of new driving license applicants in the queue system (L_s) is 1 to 2 applicants, the number of applicants in the queue (L_q) is one applicant, the waiting time for applicants in the queue system (W_s) in the registration phase is around 0.105 hours to 0.152 hours, in the photo phase about 0.129 hours to 0.364 hours, in the test phase about 0.166 hours to 0.437 hours. While the waiting time for applicants in the queue (W_q) in the registration phase is about 0.017 hours to 0.022 hours, in the photo phase, it is around 0.009 hours to 0.028. In the test phase, it is approximately 0.011 hours to 0.037 hours. This result shows that adding one service on certain days and steps can reduce the number of driving license applicants in the queue so that applicant satisfaction with the services provided by the Sumbawa Besar City Resort police staff will be achieved.

4. CONCLUSIONS

Based on the analysis of calculations carried out on the queue system for a driving license application at the Sumbawa Besar City Police, it can be concluded as follows.

1. The existing queuing system for new driving license applications is not optimal
2. Adding one service facility from Tuesday to Friday, especially in the photo and test phases, can optimize the queue system for new applications for driving licenses at the Sumbawa Besar City Police.

ACKNOWLEDGEMENT

The research team would like to thank the Sumbawa Besar City Police leadership for permitting us to discuss the queue for applying for a driving license

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