# Analysis Queue Gas Station 34-13907 East Jakarta City

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***Abstract*** *—The purpose of this study was to analyze the performance of the queuing system services and facilities for refueling at SPBU 34-13907, East Jakarta City. The research strategy used is descriptive. The research method used by researchers is the observation method. The type of queuing system model at SPBU 34-13907 East Jakarta is Multi Channel Single-Phase (M / M / S). The service system used by SPBU 34-13907 in East Jakarta is First Come First Served (FCFS), namely first-come, first-served customers. Researchers took data by observing for 5 days for 7 hours. The data obtained by researchers is in the form of how many consumers are queuing per hour. The results of research at SPBU 34-13907 East Jakarta City using queuing theory analysis, namely by calculating the Multiple Line Queuing Model is optimal. Because the average level of consumers waiting in the queue (Lq) is 0.38802 or 0 consumers. Although at the time of the study, there were queues that occurred during busy hours, namely at 08.00-09.00. because the level of arrival of consumers at these hours continues to increase every day.*

***Keywords:*** *Queue, Queuing system services, Gas Station.*

***Abstrak*** *— Tujuan dari penelitian ini adalah untuk menganalisis kinerja pelayanan sistem antrian dan fasilitas untuk pengisian bahan bakar di SPBU 34-13907 Kota Jakarta Timur. Strategi penelitian yang digunakan adalah deskriptif. Metoda penelitian yang digunakan oleh peneliti yaitu metoda observasi. Jenis model sistem antrian pada SPBU 34-13907 Kota Jakarta Timur adalah Multi Channel Single-Phase (M/M/S). Sistem pelayanan yang digunakan SPBU 34-13907 Kota Jakarta Timur yaitu First Come First Served (FCFS) yaitu konsumen yang pertama datang, pertama dilayani. Peneliti mengambil data dengan melakukan pengamatan selama 5 hari selama 7 jam. Data yang di peroleh peneliti berupa berapa jumlah konsumen yang mengantri per jamnya. Hasil dari penelitian pada SPBU 34-13907 Kota Jakarta Timur dengan menggunakan analisis teori antrian yaitu dengan perhitungan Model Antrian Jalur Berganda sudah optimal. Karena tingkat rata-rata konsumen yang menunggu dalam antrian (Lq) sebesar 0.38802 atau 0 konsumen. Walaupun pada saat penelitian terdapat antrian yang terjadi pada jam-jam sibuk yaitu pada pukul 08.00-09.00. karena tingkat kedatangan konsumen pada jam-jam tersebut terus meningkat setiap harinya.*

***Kata Kunci****: Antrian, Pelayanan sistem antrian, SPBU*

# I. INTRODUCTION

A common problem in Indonesia is transportation. Transportation is used to facilitate people in daily activities. One form of ground transportation is motor vehicles. This motorcycle vehicle is already widely owned by the people of Indonesia. This is causing in Indonesia to have a high level of congestion. With a high level of demand for someone traveling this leads to an increase in the purchase rate of private vehicles both motor and car. With the increasing number of vehicle purchases it is also causing congestion in Indonesia to occur.

According to Ma'arif and Tanjung (2015:119) The queue is a waiting line situation where the number of physical unity (migrants) is trying to receive services from limited facilities (service providers), so migrants have to wait some time in line to get a turn to be served. Gas Station 34-13907 East Jakarta city is often seen long queues in some refueling lines, The long queue also occurs during rush hour which many of the motorists want to do refueling for their vehicles.

This research will look at how the service performance of queuing systems and facilities for refueling at gas stations 34-13907 East Jakarta, which is a state-owned enterprise in charge of managing oil and gas mining in Indonesia.

# II. LITERATURE STUDY

## 2.1 Research Review

The first research was conducted by ( Firdaus, 2016) with the title "Analysis of Queue Model on Customer Service (Case Study of Refueling at Jambi city gas station)". The purpose of this study is to look at the situation that occurred in the gas station queue 24.361.35 jambi city, then the data source in this study is primary data obtained from direct observation in PT field, and secondary data in the form of books related to research, while the data processing in this study uses POM / QM software for Windows 3.0. from the results of data processing can be drawn the conclusion that the model applied by gas station queue 24.361.35 Jambi city can be said optimal, this is because the number of customers who come can be served well with short queue time.

The second research was conducted by Nurfitri et al. (2016) with the title "Queue Analysis With Single Channel Model Single Pase Service At General Refueling Station (Gas Station) I Gusti Ngurahrai Palu". With the purpose of doing this research because the number of service facilities is not comparable to the rate of arrival of customers. From the results of the study using the analysis of queue theory shows that the characteristics of queues are obtained on average queues in the system (Ls) of 9 people, the average queue in queues (La) is 8 people while the chance of the number of customers in the queue (Pn) is 4.3 %. The average waiting time in the system (Ws) is 8 minutes while the average waiting time in the queue (Wa) is 7 minutes, the server busyness rate (K) is 89% while the server unemployment rate (W) is 126 10%, so the total cost to be incurred by the gas station is RP. 246,250,000.00. The cost and waiting time after the addition of one server unit, in the process of queuing at the gas station so that the optimal service is Rp. 422,500,000.00 and the average waiting time in the system (Ws) is 1 minute while the average waiting time in the queue (Wa) is 0.289 minutes.

The third research was conducted by Manalu and Palandeng (2019) with the title "Analysis of Sepede Motor Queue System at General Refueling Station (gas station) 74.951.02 Malalayang". This research was conducted to analyze the number of optimal facility paths and service performance at optimal levels. This research uses descriptive research with a quantitative approach,

which is data based on the philosophy of positivism. The method of analysis with the analysis of queue theory according to the queue model applied to gas station 74,951.02 which is the Multiple Line Queue Model means there is more than one facility line and there is only one stage of service that must be passed by the customer to complete the service. The results of the study at the gas station 74.951.02 Malalayang using the analysis of the queue theory that is with the calculation of the Multiple Line Queue Model shows that in a non-peak hour, the number of facility lines used as many as 2 lines of facilities is good, but not in the state of rush hour which is the period of 08.00-09.00 the number of customers who queue a lot. Based on the calculation by adding 1 facility line during the rush hour period that is to 3 lines of facilities, can produce the number of optimal facility lines and service performance at optimal level. Service time becomes increased when after the addition of 1 line of facilities, that is to 1.3262 minutes.

The fourth research was conducted by Polewangi (2018) with the title "Application of Queuing System at General Fuel Filling Station (gas station) 14,203.1165 PT. Medan II Industrial Estate". This research aims that decisions taken from the results of the analysis can apply to various service conditions, so that the analysis can provide useful input to solve the problem more optimally. The problem that occurs at the gas station is the large number of customers (containers) that do refueling that affects the existing queue system and causes long queues. The result of the study conducted at gas station 14,203.1165 which is the rate of customer arrival at gas station 14,203.1165 for 10 days is 2,129 vehicles. The facility service level at this gas station is 266 vehicles per hour. The service capability level per lane is 53 vehicles. The most appropriate queue model applied at gas stations 14.203.1165 is Multi Channel- Single Phase. Characteristics of the queuing system are the unlimited population, queue discipline, arrival pattern and unlimited queue length.

The fifth research was conducted by Sofyan and Meutia (2017) with the title "Application of Queue Method in Determining Optimal Facilities at Mawaddah Gas Station". Mawaddah Gas Station is one of the gas stations located in Batuphat Timur Village Lhokseumawe. The gas station has 5 oil pumps consisting of premium with two pumps, diesel consists of two pumps, and pertamax consists of one pump. Preliminary data has been made regarding the rate of arrival of vehicles at each pump, which is a premium two-wheeled vehicle filling pump from 195 vehicles, four or more 166 wheels or four-wheeled filling pumps, four or more diesel fuel pumps of 156 and 138 feeding pumps. High levels of vehicle arrivals result in queues. To calculate the level of service has never been done so it is not known the maximum time for service at each pump. The research method used is a model of queues related to arrival rate and service level, with the result of research obtained is the rate of arrival of vehicles at each pump which is 2 wheels of premium gas station 2.59 minutes. The premium 4-wheel charging pump is 6.98. 4 wheel diesel fuel pump 5.97 minutes and first charging pump 6.65 minutes with facility number 1.Premium 2 and 4 wheel vehicle service rates are 15.52 minutes and 14.11 minutes, The 4-wheel diesel fuel pump is 14.21 minutes and the first feed pump is a 13.55 minute design scenario on each pump is Scenario 1 with 2 pumps, Probability of the system being empty 0.87500 , The number of customers in the system and the number of customers waiting in the queue each 1 customer, the average customer time in the system is 0.06696 minutes and the wait time for the customer in the queue is 0.00030 minutes.

The sixth research was conducted by Xu et al. (2018) with the title "*Optimization of energy supply system under information variations based on gas stations queuing analyses". Owing to the expansion of large cities, especially in China, gas stations queuing issues increasingly challenge normal operations and the fluidity of the entire transportation system. In fact, energy supply system is an important part of the traffic system, and the rapid access to refueling services positively affects the population's travel experience. The purpose of this study is to use queuing theory to*

*analyze one typical layout with two gas stations (G1 and G2) under two different conditions: Absence of queuing information guidance and availability of real-time queuing information at the gas station. Mathematical reasoning and numerical experiments prove that the mean customer acceptance rate increases and the mean waiting time decreases in two M/M/1/2, M/M/1/3 and M/M/2/3 models under information guidance. In addition, we compare the fluctuation of service intensities of G1 and G2 under the conditions defined above and find that the capacities of gas stations G1 and G2 are balanced. Furthermore, numerical simulations for M/M/1/4 and M/M/2/4 models are undertaken to yield the same conclusions regarding capacity balance in other types of gas station. In summary, transferring real-time information to drivers is helpful to optimize the management and reduce the negative effects of queuing at gas stations, and should be considered in relevant sectors.*

The seventh study was conducted by Kembe et al. (2017) titled *"Application of Queueing Theory to Customers Purchasing Premium Motor Spirit (PMS) at a Filling Station". The formation of waiting lines is a prevalence scenario that happens whenever the immediate demand for a service surpass the current capacity to provide that service. This discrepancy may be temporal, but a queue accumulates during the period. Formation of a line causes an increase of customers waiting time, over-utilization of the available servers and loss of customer goodwill. Application of Queueing theory determines the measures of performance of the service facility; this can be used to design the appropriate service facility. Data for this study was collected at Nigeria National Petroleum Corporation (NNPC) Mega Station Jos for seven consecutive days between the hours of 7am-6pm daily through observations, interviews, and records of customers purchasing PMS only. The multi-server model was adopted for the study of the existing structure has eight servers. The data was analyzed using descriptive analysis; Minitab-16 and TORA- 2.0 software. The arrival rate $\lambda$=2.7483 customers/min is greater than the service rate $\mu$=0.4137 customer/min showing that queue exists. There are Poisson arrivals and exponential service distributions as validated by a Chisquare goodness of fit test. The calculated mean of utilization factors for five scenarios is 67.808%.The utilization factor of 66.432 % obtained for M/M/10: FCFS/∞/∞ is the closest to this mean value and hence selected as the average utilization factor. This model that yielded an average queue time of 0.12353 minute and an average queue length of 0.33948 customers was formulated. M/M/10 gave optimal results and were proposed for adoption and to be used for solving similar problems. Management should open up two more servers. Incentives should be given to creating over time that will increase or sustain the acceptable utilization factor. Any utilization factor value below 66.432 % is not encouraged for this system as it will increase idle time.*

The eighth study was conducted by Balaji (2017) entitled *"Optimal Resource Model Using Matlab / Simulink controlled Queuing System Using Multiserver At Major Fuel Stations". This paper focuses on Matlab-Simulink Model of a Petrol bunk. The development of the new queuing multi-service model is continuously enhanced because the critical situation the customer activities are being attempted to gain improvement of time effective and prompt service at Petrol Bunk station. Queuing theory can be used to predict some important parameters like Average waiting time and queue length in the petrol pump station. Simulation provides a good strategy to analyze the client-server systems and help in the better implementation of feasible solutions. This model allows the prediction and behavior of the queue under different physical and different time occasions with experiment test and obtained the excellent results with simulation and also describes these of queuing systems to decrease the waiting time of customers.*

## 2.2 Understanding of Oprasional Management

Operation management is an activity related to the creation of goods and services through the process of transforming from input to output (Heizer and Render, 2016:4).

## 2.3 Understanding of Services

The product is a creation of goods and services. The activity of creating goods and services exists in all organizations. According to Heizer and Render (2016:7) Services are economic activities that usually produce an intangible product.

## 2.4 Definition of Queue Theory

The collection of knowledge about the waiting line, often referred to as queuing theory, is an important part of operational activities and a valuable tool for operations managers. According to Heizer and Render (2016:852) Queuing theory is a common situation.

## 2.5 Queuing System

The characteristics of the second waiting line relate to queue discipline. Queue discipline is a decision rule that explains how to serve queues according to Siagian (2016). There are 5 forms of service discipline that can be used consisting of:

a. First Come First Served (FCFS) or First In First Out (FIFO) which is the first customer to come, first served. For example: queuing systems at cinemas, supermarkets, toll gates, and more.
b. Last Come First Served (LCFS) or Last In First Out (LIFO) i.e. customer queue system that comes last, first served. For example: the queuing system on the elevator elevator for the same floor.
c. Service in Random Order (SIRO) is a call based on random odds, no matter who comes first.
d. Shortest Operation Times (SOT) is a service system that takes the shortest service time to get the first service.
e. Priority Service (PS) is the priority of service given to customers who have a higher priority than customers who have low priority, although the latter may have arrived first on the waiting line.

## 2.6 Queue Structure

There are four basic queue structure models that are common in the entire queue system.

a. Single Channel – Single Phase
   Single Channel means that there is only one line to enter the service system or there is one service. Single Phase indicates that there is only one service station so that those who have received the service can go straight out of the queue system.
b. Single Channel Multi Phase
   This structure has one service line so it is called Single Channel. The term Multi Phase indicates that there are two or more services implemented sequentially. After receiving the service because there are still other services that need to be done to be perfect. After the service provided perfectly new can leave the service area.
c. Multi Channel Single Phase
   The Multi Channel Single Phase system occurs when two or more facilities are flowed by a single queue. This system has more than one service line or service facility while the service system is only one phase.
d. Multi Channel Multi Phase Each of these systems has several service facilities at each stage, so that more than one individual can be served at a time. In general this network is too complex to be analyzed with queue theory.

### 2.7 Queue Model

According to Heizer and Render (2016:859-869) the four models most commonly used by the company by adjusting their respective situations and conditions. The four queue models are as follows:

a. Model A (M/M/I) (Single Channel Query System or single-line queue model).
   In this situation, the arrival forms a single line to be served by a single station.
b. Model B M/M/S ( Multiple Channel Query System or multiple line queue model)
   Multiple line queuing systems have two or more lines or service stations available to handle future customers.
c. Model C: M/D/1 (constant service or constant service time)
   Some systems have a fixed service time, and are not as exponentially distributed as usual
d. Model D: (limited population)
   This model is different from the other three models, as there is currently a interdependence relationship between queue length and arrival rate

### 2.8 Relationship between Research Variables

In this study there was only one standalone variable. The independent variables used in this study are queues of arrivals and customer wait times. According to Sugiyono (2016:53) self-contained variables are stand-alone variables instead of independent variables because if independent variables are always paired with dependent variables.

## III. RESEARCH METHODS

The research strategy used is a descriptive strategy. The research method to be used in this study is the observation method. Researchers can see and observe directly how the situation and conditions at gas stations 34-13907 East Jakarta that last as long as consumers are served by gas station operators and researchers will observe and analyze the number of consumer arrivals within 60 minutes for 7 hours in one day

Looking at the analysis unit above, then the withdrawal of samples in this study is to use Purposive Random Sampling. According to Sugiyono (2017:84) suggesting that "Purposive Random Sampling is a technique of determination until with certain considerations.".

In this study, data collection was conducted to obtain the necessary information for problem limitation in the study. The methods used are as follows:

1) Primary Data
2) Secondary Data

The data processing and discussion phase is carried out in the following ways:

1) Identify transactions contained in refueling.
2) Evaluate and reprocess the data and information that has been obtained.
3) Perform data processing using POM-QM software for Windows version 5.3
4) Presenting and concluding the results of the analysis of queues at gas stations 34-13907 East Jakarta

## IV. RESEARCH RESULTS AND DISCUSSIONS

### 4.1 Research Data Analysis

Gas station 34-13907 East Jakarta city operates for 7 days a week. And has an operating hours of 15 hours, gas station service time starting from 06.00 – 21.45 WIB. The service provided by refueling for vehicles is called Gas Station Operator. Researchers took the data by making

observations for 5 days starting from July 6, 2020 to July 10, 2020. Data on the arrival of Gas Station Consumers 34-13907 East Jakarta from the following 5 days observation results:

*Table 4.1. Consumer Arrival Data Per Business Hour 08.00-15.00*

| No | Date | Weekday | 08.00-09.00 | 09.00-10.00 | 10.00-11.00 | 11.00-12.00 | 12.00-13.00 | 13.00-14.00 | 14.00-15.00 | Total Consumers |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 6 July 2020 | Monday | 69 | 55 | 57 | 37 | 21 | 31 | 37 | 307 |
| 2 | 7 July 2020 | Tuesday | 73 | 48 | 44 | 12 | 35 | 29 | 32 | 273 |
| 3 | 8 July 2020 | Wednesday | 82 | 49 | 45 | 21 | 29 | 37 | 29 | 292 |
| 4 | 9 July 2020 | Thursday | 74 | 50 | 48 | 23 | 28 | 32 | 33 | 288 |
| 5 | 10 July 2020 | Friday | 85 | 62 | 53 | 44 | 39 | 49 | 51 | 383 |
| Total Consumers/Hours | | | 383 | 264 | 247 | 137 | 152 | 178 | 182 | |

Source: Research Processed Data (2020)

Based on table 4.1 on consumer arrival data per day, it can be seen that the highest consumer arrival occurred at 08.00-09.00 which reached 383 consumers while the lowest consumer arrival occurred at 11.00-12.00 which reached 137 consumers. From 12:00 to 15:00 there is an increase in consumer arrivals.

## 4.2 Queue System Analysis

The queue system at gas station 34-13907 East Jakarta is a multiple line, hence the queue model that is used namely M/M/S. At the time of observation, researchers should know the number of gas station operators operating (M), average boarding arrival rate (λ) and average service level (μ). The next calculation is to look for Lq, Ls, Wq, Ws, ρ and Po. Strandar Service Operator gas station to serve consumers is 30 seconds per consumer with a time interval of 60 minutes, then the average number of waiter level (μ) is 120 consumers. Calculation of performance results with the 2 gas station operators can be seen in the explanation by using POM-QM software as follows:

Figure 4.1 Performance Results on Monday, July 6, 2020

SENIN Solution

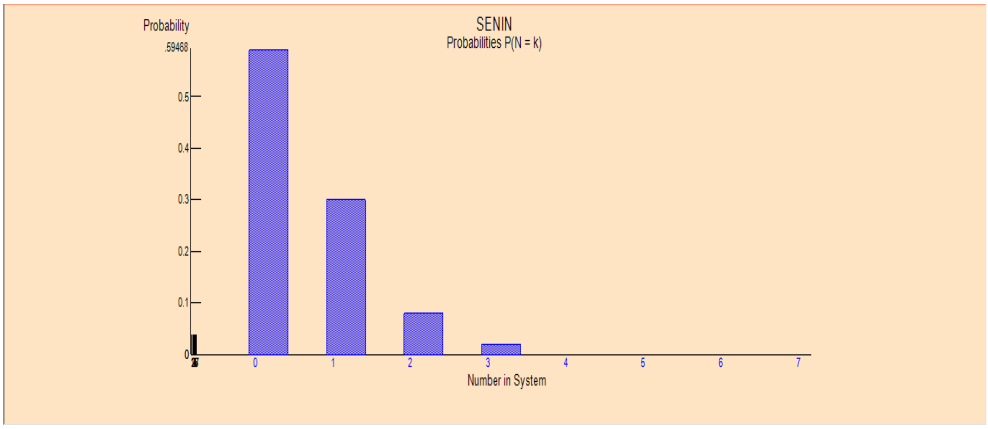
| Parameter | Value | | Parameter | Value | Minutes | Seconds |
|---|---|---|---|---|---|---|
| M/M/s | | | Average server utilization | .25417 | | |
| Arrival rate(lambda) | 61 | | Average number in the queue(Lq) | .03511 | | |
| Service rate(mu) | 120 | | Average number in the system(L) | .54344 | | |
| Number of servers | 2 | | Average time in the queue(Wq) | .00058 | .03453 | 2.07187 |
| | | | Average time in the system(W) | .00891 | .53453 | 32.07187 |

*Source: Data processed with POM-QM software (2020)*

Description:

1. The average consumer arrival rate (λ) on Monday, July 6, 2020 is 61 consumers per hour with a maximum service time standard of 30 seconds per consumer.
2. Average service level (μ) of 120 consumers per hour.
3. Number of Operators operating (M) as many as 2 people.
4. Service probability level (ρ) of 0.25417 or 25.41%.
5. The average number of consumers waiting in the queue (Lq) is 0.03511 or 0 consumers.
6. The average number of consumers waiting in the system (Ls) is 0.54344 or 0 consumers
7. Average waiting time spent by consumers in queue (Wq) of 0.03453 minutes
8. The average waiting time spent by consumers in the system (Ws) is 0.53453 minutes.

Figure 4.2 Probability Chart Monday, 6 July 2020




*Source: Data processed with POM-QM software (2020)*

Seen in the graph the probability of an average of 0 kosumen in the system (Po) of 0.59468 or 59.46%. The following is also presented the sensitivity of the values ρ, Lq, Ls, Wq and Ws if the Operator is open other than 2 services.

Figure 4.3 Performance Results on Tuesday, July 7, 2020

SELASA Solution

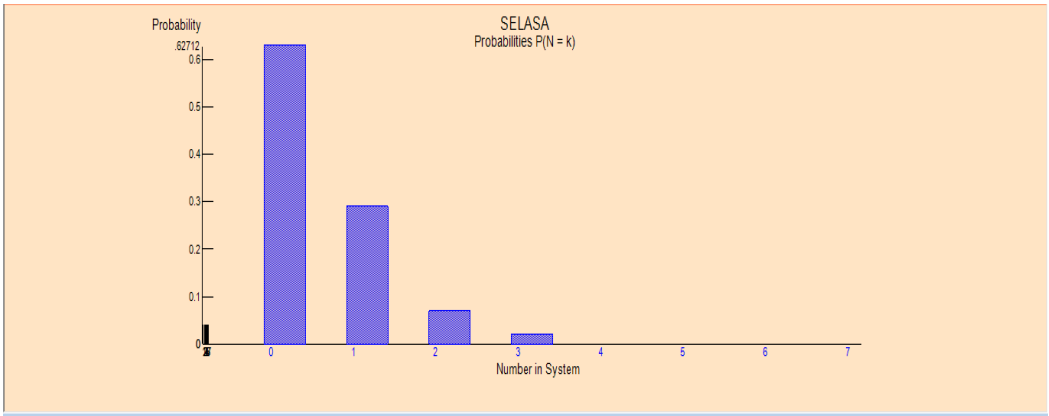
| Parameter | Value | | Parameter | Value | Minutes | Seconds |
|---|---|---|---|---|---|---|
| M/M/s | | | Average server utilization | .22917 | | |
| Arrival rate(lambda) | 55 | | Average number in the queue(Lq) | .0254 | | |
| Service rate(mu) | 120 | | Average number in the system(L) | .48374 | | |
| Number of servers | 2 | | Average time in the queue(Wq) | .00046 | .02771 | 1.66285 |
| | | | Average time in the system(W) | .0088 | .52771 | 31.66285 |

*Source: Data processed with POM-QM software (2020)*

Description:

1. The average consumer arrival rate (λ) on Tuesday, July 7, 2020 is 55 consumers per hour with a standard service time of maximum 30 seconds per consumer.
2. Average service level (μ) of 120 consumers per hour.
3. Number of Operators operating (M) as many as 2 people.
4. Service probability level (ρ) of 0.22917 or 22.91 %.
5. The average number of consumers waiting in the queue (Lq) is 0.0254 or 0 consumers.
6. The average number of consumers waiting in the system (Ls) is 0.48374 or 0 consumers
7. Average waiting time spent by consumers in queue (Wq) of 0.02771 minutes
8. The average waiting time spent by consumers in the system (Ws) is 0.52771 minutes.

Figure 4.4 Probability Graph Tuesday, 7 July 2020




*Source: Data processed with POM-QM software (2020)*

Seen in the average probability chart of 0 consumers in the system (Po) of 0.62712 or 62.71%. The following is also presented the sensitivity of the values ρ, Lq, Ls, Wq and Ws if the Operator is open other than 2 services.

Figure 4.5 Performance Results on Wednesday, July 8, 2020

RABU Solution

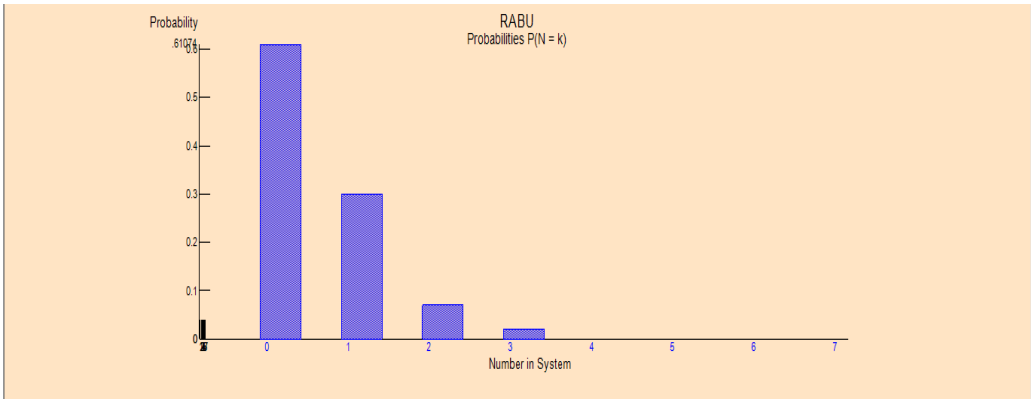
| Parameter | Value | | Parameter | Value | Minutes | Seconds |
|---|---|---|---|---|---|---|
| M/M/s | | | Average server utilization | .24167 | | |
| Arrival rate(lambda) | 58 | | Average number in the queue(Lq) | .02998 | | |
| Service rate(mu) | 120 | | Average number in the system(L) | .51331 | | |
| Number of servers | 2 | | Average time in the queue(Wq) | .00052 | .03101 | 1.86076 |
| | | | Average time in the system(W) | .00885 | .53101 | 31.86075 |

*Source: Data processed with POM-QM software (2020)*

Description:

1. The average consumer arrival rate (λ) on Wednesday, July 8, 2020 is 58 consumers per hour with a standard service time of maximum 30 seconds per consumer.
2. Average service level (μ) of 120 consumers per hour.
3. Number of Operators operating (M) as many as 2 people.
4. Service probability level (ρ) of 0.24167 or 24.16 %.
5. The average number of consumers waiting in the queue (Lq) is 0.02998 or 0 consumers.
6. The average number of consumers waiting in the system (Ls) is 0.51331 or 0 consumers
7. Average waiting time spent by consumers in queue (Wq) of 0.03101 minutes
8. The average waiting time spent by consumers in the system (Ws) is 0.53101 minutes.

Figure 4.6 Probability Graph Wednesday, 8 July 2020




*Source: Data processed with POM-QM software (2020)*

Seen in the average probability chart of 0 consumers in the system (Po) of 0.61074 or 61.07%. The following is also presented the sensitivity of the values ρ, Lq, Ls, Wq and Ws if the Operator is open other than 2 services.

Figure 4.7 Performance Results on Thursday, 9 July 2020

KAMIS Solution

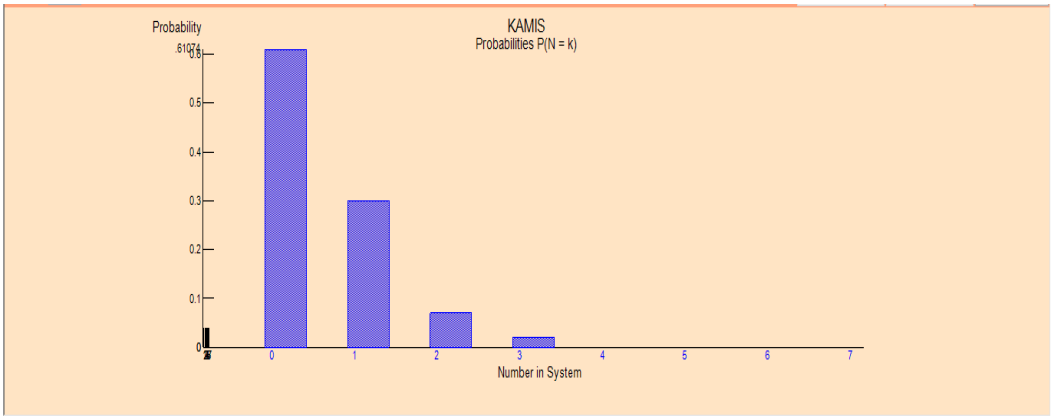
| Parameter | Value | | Parameter | Value | Minutes | Seconds |
|---|---|---|---|---|---|---|
| M/M/s | | | Average server utilization | .24167 | | |
| Arrival rate(lambda) | 58 | | Average number in the queue(Lq) | .02998 | | |
| Service rate(mu) | 120 | | Average number in the system(L) | .51331 | | |
| Number of servers | 2 | | Average time in the queue(Wq) | .00052 | .03101 | 1.86076 |
| | | | Average time in the system(W) | .00885 | .53101 | 31.86075 |

*Source: Data processed with POM-QM software (2020)*

Description:

1. The average consumer arrival rate (λ) on Thursday, July 9, 2020 is 58 consumers per hour with a standard service time of maximum 30 seconds per consumer.
2. Average service level (μ) of 120 consumers per hour.
3. Number of Operators operating (M) as many as 2 people.
4. Service probability level (ρ) of 0.24167 or 24.16 %.
5. The average number of consumers waiting in the queue (Lq) is 0.2998 or 0 consumers.
6. The average number of consumers waiting in the system (Ls) is 0.51331 or 0 consumers
7. Average waiting time spent by consumers in queue (Wq) of 0.03101 minutes
8. The average waiting time spent by consumers in the system (Ws) is 0.53101 minutes

Figure 4.8 Probability Chart Thursday, 9 July 2020




*Source: Data processed with POM-QM software (2020)*

Seen in the average probability chart of 0 consumers in the system (Po) of 0.61074 or 61.07%. The following is also presented the sensitivity of the values ρ, Lq, Ls, Wq and Ws if the Operator is open other than 2 services.

Figure 4.9 Performance Results on Friday, July 10, 2020

JUMAT Solution

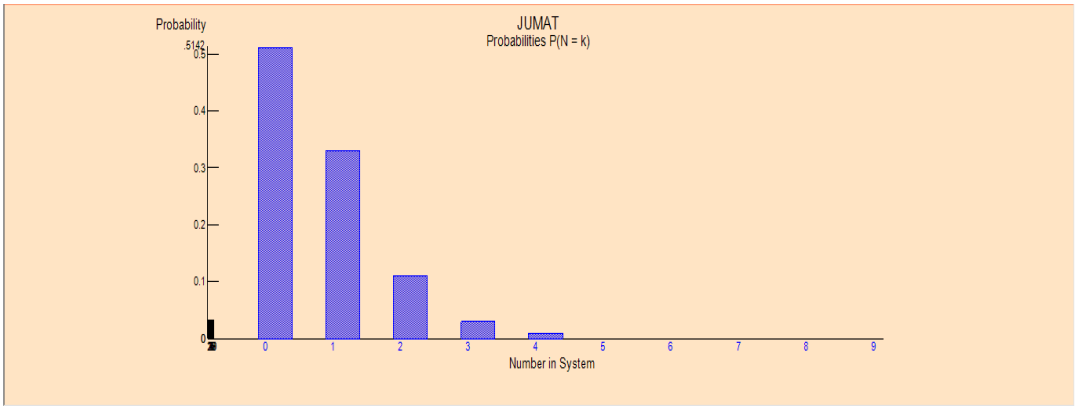
| Parameter | Value | | Parameter | Value | Minutes | Seconds |
|---|---|---|---|---|---|---|
| M/M/s | | | Average server utilization | .32083 | | |
| Arrival rate(lambda) | 77 | | Average number in the queue(Lq) | .07363 | | |
| Service rate(mu) | 120 | | Average number in the system(L) | .71529 | | |
| Number of servers | 2 | | Average time in the queue(Wq) | .00096 | .05737 | 3.44236 |
| | | | Average time in the system(W) | .00929 | .55737 | 33.44236 |

*Source: Data processed with POM-QM software (2020)*

Description:

1. The average consumer arrival rate (λ) on Friday, July 10, 2020 is 77 consumers per hour with a maximum service time standard of 30 seconds per consumer.
2. Average service level (μ) of 120 consumers per hour.
3. Number of Operators operating (M) as many as 2 people.
4. Service probability level (ρ) of 0.32083 or 32.08%.
5. The average number of consumers waiting in the queue (Lq) is 0.07363 or 0 consumers.
6. The average number of consumers waiting in the system (Ls) is 0.71529 or 0 consumers
7. Average waiting time spent by consumers in queue (Wq) of 0.05737 minutes
8. The average waiting time spent by consumers in the system (Ws) is 0.55737 minutes.

Figure 4.10 Probability Chart Friday, 10 July 2020




*Source: Data processed with POM-QM software (2020)*

Seen in the average probability chart of 0 consumers in the system (Po) of 0.5142 or 51.%. The following is also presented the sensitivity of the values ρ, Lq, Ls, Wq and Ws if the Operator is open other than 2 services.

Based on the data obtained by the researchers in figure 4.1 of figure 4.10, here are the results of queue performance at gas stations 34-13907 East Jakarta city for 5 days with 2 gas station operators operating.

Table 4.2. Result of Queue Performance at Gas Station 34-13907 East Jakarta City for 5 Days with 2 Gas Station Operators operating:

| Variabel Name | Value | | | | |
|---|---|---|---|---|---|
| | Monday | Tuesday | Wednesday | Thursday | Friday |
| λ/Hours | 61 | 55 | 58 | 58 | 77 |
| μ | 120 | 120 | 120 | 120 | 120 |
| M | 2 | 2 | 2 | 2 | 2 |
| ρ | 0.25417 | 0.22917 | 0.24167 | 0.24167 | 0.32083 |

| | | | | | |
|---|---|---|---|---|---|
| Po | 0.59468 | 0.62712 | 0.61074 | 0.61074 | 0.5142 |
| Lq | 0.03511 | 0.0254 | 0.02998 | 0.02998 | 0.07363 |
| Ls | 0.54344 | 0.48374 | 0.51331 | 0.51331 | 0.71529 |
| Wq | 0.03453 | 0.02771 | 0.03101 | 0.03101 | 0.05737 |
| Ws | 0.53453 | 0.52771 | 0.53101 | 0.53101 | 0.55737 |

*Source : Processed Data (2020)*

From the above summary data contained in table 4.2, it can be recalculated the average observations made by researchers for 5 days with 2 gas station operators operating at gas stations 34-13907 East Jakarta.

Table 4.3. The Results of The Calculation of Average Queue Performance Results at gas stations 34-13907 East Jakarta City for 5 Days with 2 Gas Station Operators operating:

| Variabel Name | Average calculation result (from table 4.2.) |
|---|---|
| λ/Hours | 61.8 |
| μ | 120 |
| M | 2 |
| ρ | 0.257502 |
| Po | 0.591496 |
| Lq | 0.03882 |
| Ls | 0.553818 |
| Wq | 0.036326 |
| Ws | 0.536326 |

*Source : Processed Data (2020)*

Based on Table 4.3. can be analyzed by researchers that gas station 34-13907 East Jakarta has operators operating (M) of 2 people. With an average consumer arrival rate (λ) of 61.8 (62) consumers per hour with a maximum service time standard of 30 seconds per consumer. Average probability or service usability rate (ρ) of 0.257502 or 25.75 %. There is an average probability of consumers in the system (Po) or consumers being served plus consumers who are waiting by 0.591496 or 59.14 %

Then the average number of consumers waiting in the queue (Lq) is 0.03882 or 0 consumers. And the average waiting time spent by consumers in queues (Wq) is 0.036326 minutes. That shows that the average consumer waiting in line is 0 consumers. Meanwhile, the average number of consumers waiting in the system (Ls) is 0.553818 or 0 consumers. and the average

waiting time spent by consumers in the system (Ws) is 0.536326 minutes. That shows that the average consumer waiting in the system is 0 consumers.

## V. CONCLUSIONS AND SUGGESTIONS

### 5.1. Conclusions

1. The type of queue model applied at gas station 34-13907 East Jakarta is the type of queue system model Multiple Channel System or (M/M/S). Where there are 2 gas station operators that serve consumers and consumers can only skip one transaction or refueling.
2. The service discipline applied to gas station 34-13907 East Jakarta is the discipline of First Come First Served (FCFS). Where the first consumer comes will be the first to be served.
3. The queue system at gas station 34-13907 East Jakarta is optimal. Because it can be seen from the calculation of the average results of queue performance at gas stations, the average rate of consumers waiting in queues (Lq) is 0.38802 or 0 consumers. So during the study no consumers waited in line. Although at the time of the study there were queues that occurred during rush hour which is at 08.00-09.00. because the level of consumer maturity in these hours continues to increase every day.

### 5.2. Suggestion

**1.** The performance of the queue system at gas station 34-13907 East Jakarta is optimal. In terms of operator service, the hospitality and comfort of the service must be improved so that the customers who are queuing feel comfortable.

**2.** Increase the speed when providing services to consumers, so that during rush hour queues can be minimized.

**3.** In terms of the security of queues at gas stations 34-13907 East Jakarta city should also be more considered so that there is no sesame consumers overtaking other kosumen who first queue.

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