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Effectiveness Analysis of Arrival-Departure Service in Sultan Hasanuddin International Airport Mandai South Sulawesi

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Abstract. *The Purpose of this study: (1) To analyze the effectiveness of air services suddenly departed at Sultan Hasanuddin International Airport Mandai South Sulawesi. (2) To determine the aircraft parking apron arriving and ready to be dispatched is still adequate. Methods of data analysis used in this study adapted to the characteristics of the runway at the Sultan Hasanuddin International Airport Mandai South Sulawesi, namely (1) Using the queuing model Single Channel Single Phase (SC-SP), (2) λ = arrival rate of the average air per hour, (3) μ = aircraft capable of being served on average per hour, (4) Lq = number of units in the queue, (5) Ls = number of units in the system, (6) Wq = wait time average, (7) Ws = the average waiting time in the system, (8) P = the intensity level of service facilities. From the analysis of the data, Sultan Hasanuddin International Airport using queuing model Single Channel Single Phase (SC-SP) and the queue discipline First Come First Served (FC-FS). Average number of planes coming in was the best 5 per hour and the average number of aircraft served are the best 6 per hour. The average number in the system is the best 5 per hour and the average number of aircraft in the queue are 4 aircraft per hour. Based on the queuing model analysis for the aircraft, it indicates that the effectiveness of air services at Hasanuddin International Airport has been satisfactory, and the apron capacity is adequate.*

Keywords: *Aircraft Services, Apron, Airport*

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INTRODUCTION

Everyone generally Once experiencing the queuing process, either That in arrival or departure, entering room, waiting, until the service process going on. Things like This often We meet, both at the time queue or waiting at the bank, home sick, at airports and places general others. Anties or waiting process For get service This can make discomfort for customers and take part time For get service. Because of time is source valuable power, reduction in time waiting is Topic important in analysis. So that company must own strategy in system queue to make customers feel comfortable and firm No lost customers. The company must do optimization service among others with make effective time service will but still prioritize quality service (Prasetio, 2021; gmach et al., 2008; Rust et al., 1995).

Siagian (1987) stated that that Lots matter addition facility service can given for reduce queue or For prevent the emergence queue. However, the cost Because give service additionally, will cause subtraction profit Possible down to the bottom level that can accepted (Dandl et al., 2021). On the contrary, often the emergence long queue will result in the disappearance subscriber or customers. So, the problems faced by managers is How to strive balance between

cost wait (queue) for cost prevent queue That Alone use to obtain maximum profit (Veeraraghavan & Debo, 2009; Allon et al., 2011; Sherman & Zhu, 2006). Kokasih & Dr (2009) also stated that the queue model very important for manager Because will help him in taking decision, also in analysis cost services provided with cost wait for what to do issued Consumers. Analysis That includes: average time sacrificed consumer during is at in queue (time wait for turn served), average queue length (number of customer in queue), average time sacrificed consumer (Lin et al., 2015; Song et al., 2024; Ülkü et al., 2022).

Airport Sultan Hasanuddin International is the serving airport flight domestic and foreign. What is meant by customer here is all aircraft flying that will fly or off landing *(take off)* and the plane flying that will landed (*landing)*, and as a server is the airport International Sultan Hasanuddin. According to study previously which has conducted by Mahyuddin et al. (2013), from observation at Sultan Hasanuddin International Airport found the amount queued planes for take off *and* the number of queued planes For landing (*landing*). This is cause queue in use runway spur. From the condition queue aircraft flying at Sultan Hasanddin International Airport, can looking for a suitable queue mduring is at in system (time wait in queue added time during served), average number of subscriptions in system, probability facilities service in condition empty *(idle),* probability that No There is subscriber in systemodel that can describe condition from the model (Rachman, 2009; Sari, 2022; Hendrianto, 2004; Gustiawati, 2022). will searching for among others the average number arrival aircraft, average time service and size required performance like amount estimated customers in system, number estimated customers in queue, time waiting for the expected in system and time waiting for the expected in queue. Of all size performance can seen effectiveness system services available at Sultan Hasanuddin International Airport.

METHODS

Method study in journal This use approach quantitative and qualitative, which aims for analyze effectiveness service aircraft Arrive at the Airport International Sultan Hasanuddin, South Sulawesi. Data collection was carried out through observation live, interview with party related, and studies documentation. Primary data comes from from results observation field, while secondary data obtained from references and documents Supporters. The data processing process is carried out with approach statistics using the queue model Single Channel Single Phase (SC-SP) For analyze channel arrival and departure plane at the airport. This model covers average rate calculation arrival aircraft (λ), the average aircraft that can served (μ), number aircraft in system (Ls), number aircraft in queue (Lq), and average waiting time in the system (Ws) and queue (Wq). Analysis done for evaluate whether parking apron capacity and effectiveness service is already optimal. Based on results analysis, airport use discipline queue First Come First Served (FCFS), with an average of 5 aircraft come and 6 planes served per hour, which shows service airport effective and sufficient apron capacity for need moment this.

RESULTS AND DICUSSION

Based on results secondary data research October 1, 2015 – October 31, 2015 obtained amount incoming plane as many as 3916 aircraft, and aircraft departing as many as 3876 aircraft. Can seen on table 1.

Table 1. Recapitulation of arrival and departure data plane at the airport Sultan Hasanuddin International Mandai South Sulawesi.

Day/Date	Number Of Aircraft The Arrived	Number Of Aircraft Who Departed
October 1, 2015	127	128
October 2, 2015	128	125
October 3, 2015	126	129
4 October 2015	132	129
5 October 2015	129	132

6 October 2015	123	123
7 October 2015	131	125
8 October 2015	125	125
9 October 2015	135	133
10 October 2015	130	131
11 October 2015	129	132
12 October 2015	128	128
13 October 2015	123	122
14 October 2015	124	124
15 October 2015	125	123
16 October 2015	125	120
17 October 2015	128	120
18 October 2015	126	129
19 October 2015	129	128
20 October 2015	122	124
21 October 2015	124	117
22 October 2015	118	115
23 October 2015	122	115
24 October	127	120
25 October	130	131
26 October	132	131
27 October	123	123
28 October	120	118
29 October	123	125
30 October	126	124
31 October	126	127
Total	**3916**	**3876**

Apron

Figure 1. Shrimp 8. Apron

As for number of aprons available at the airport Sultan Hasanuddin International South Sulawesi Mandai as many as 37.

Analysis of research results

Using the Single Channel Single Phase (SC-SP) queue model and using discipline queue namely First Come First Served (FCFS) or First in First Out (FIFO) which means, more Formerly come (arrive), more Formerly served (out). The one who gives contact first, then that's what will be land first and vice versa.

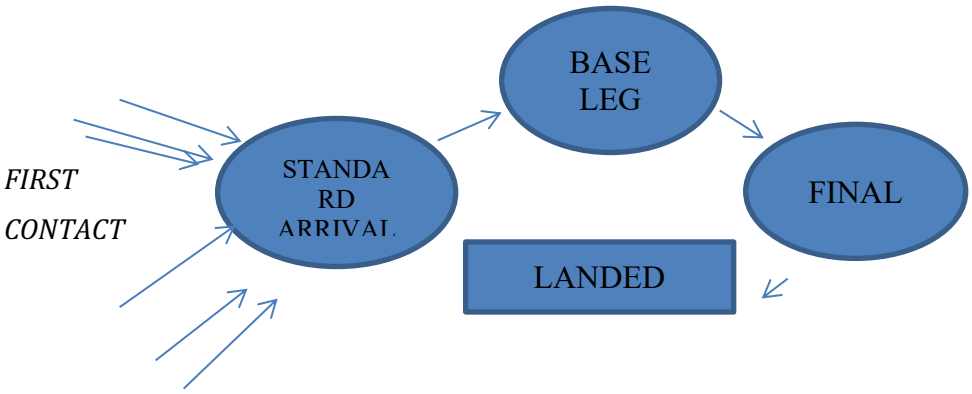

Figure 9. Arrival

Figure 3. Standard Arrival

Figure 4. Base leg

Figure 5. Final

Figure 6. Landing

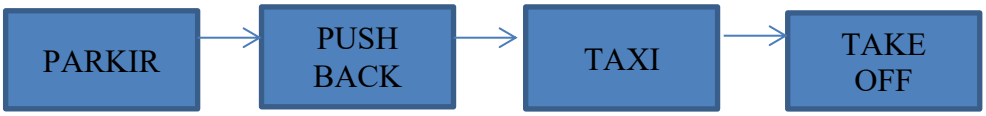

Figure 7. Departure

Figure 8. Parking

Figure 9. Push back

Figure 10. Taxation

Figure 11. Take off

Average arrival rate of aircraft per hour

From the data in table 1, it will be counted average number of incoming aircraft per hour and the average number of departing aircraft per hour.

Average number of incoming aircraft per hour:

$$\lambda = \frac{\textit{Amount incoming plane}}{\textit{Lots time measurement per day x time interval measurement per day}}$$

$$= \frac{3916}{31 \times 24}$$

$$= \frac{3916}{744}$$

$$= 5.26$$

$$= 5 \text{ planes}$$

So, the average number of planes arriving per hour that is as many as 5 planes.

The aircraft is capable of served on average per hour

$$\mu = \frac{\textit{Amount capable aircraft served}}{\textit{Lots time measurement per day x time interval measurement per day}}$$

$$= \frac{132}{24}$$

$$= 5.5$$

$$= 6 \text{ planes}$$

So, the average number of aircraft capable of served per hour that is as many as 6 planes.

Intensity level facility service

From the results analysis of the data obtained that:

λ = 5 planes per hour

μ = 6 planes per hour

So:

$\rho = \frac{\lambda}{\pi}$

$= \frac{5}{6}$

= 0.83 or 83%

Opportunity No existence aircraft served = 100% - 83% = 17 % note: (very Busy)

average number in queue

$Lq = \frac{\lambda^2}{\mu(\mu-\lambda)}$

$= \frac{5}{6(6-5)}$

$= \frac{25}{6}$

= 4,167

= 4.17

So, the average number of planes in queue is as much as 4 planes.

Average number of aircraft in system

It is known:

E[t] = expectation time service

$E[t] = \frac{1}{\pi}$

$E[t] = \frac{1}{6}$

= 0.167

Variance $= \frac{1}{\mu^2}$

$= \frac{1}{(6)^2}$

$= \frac{1}{36}$

=0.027

The formula used:

Ls = Lq + r

= 4.17 + 0.83

= 5 planes

So, the average number of planes in system is as many as 5 planes.

Average waiting time in system

Ws $= \frac{Ls}{\lambda}$

$= \frac{5}{5}$

= 1 per hour

So, time waiting for the average plane in system is 1 per hour.

Average waiting time in queue

Wq $= \frac{Lq}{\lambda}$

$= \frac{4}{5}$

= 0.8 per hour

So, time waiting for the average plane in queue is 0.8 per hour.

After doing calculation of result data study seen that the average number of arriving aircraft (λ) is 5 aircraft per hour and the average number of aircraft capable of served (μ) is 6 aircraft per hour and is visible that average number of aircraft in system (Ls) is 5 planes in per hour and average number of aircraft in queue (Lq) is 4 planes per hour so can seen that queue plane at the airport Sultan Hasanuddin International Mandai South Sulawesi has effective.

Compared to with study previously conducted by Aminah, Aidawayati R, Kresnajaya A (2013) entitled queue model aircraft fly at International Airport Hasanuddin Makassar, the average number of incoming aircraft (λ) and the average number of aircraft capable of served (μ) the same that is as many as 6 planes per hour. The average number of planes in system is 24 aircraft per hour and the average number of aircraft in queue is 23.86 planes per hour so can seen that in research conducted by Aminah, Aidawayati R, Kresnajaya A (2013), queues plane at the airport International Sultan Hasanuddin Still Not yet effective because μ > λ while in his research μ = λ.

CONCLUSION

Based on results research that has been done for 1 month at the Airport Sultan Hasanuddin International Mandai South Sulawesi namely October 1, 2015 to October 31, 2015, then can concluded that: Service aircraft Arrive at the Airport Sultan Hasanuddin International Mandai South Sulawesi has effective, visible from average number of incoming aircraft is 5 aircraft per hour and the average number of aircraft served is 6 planes per hour. As for average amount in system is 5 planes per hour and the average number of planes in queue is 4 planes per hour. Parking apron the plane arrived and is ready departed very adequate with number of aprons available as many as 37 aprons.

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