ANALYSIS OF THE NEEDS OF TERMINAL AREA 1 JUANDA INTERNATIONAL AIRPORT SURABAYA

Yusuf Satya Adi Wicaksana*, Wiwid Suryono, Fahrur Rozi

Politeknik Penerbangan Surabaya, Jalan Jemur Andayani I No 73, Kota Surabaya, 60236

**Corresponding Author. Email:satyasiregar19@gmail.com*

Abstract

Juanda Surabaya International Airport has terminal 1 and terminal 2. The total area of terminal 1 is 91,700 m2. In 2014 the number of passengers reached 17,285,070 and experienced an increase in the number of passengers for 4 years until 2018 reached 20,951,063. With the increasing number of passengers at Juanda Airport and serving Umrah and Hajj flights, the terminal area will not be able to accommodate passengers in the next 20 years. Forecasting the number of passengers for the next 20 years using the linear regression method with software. The results of passenger forecasting in 2043 reached a total of 51,393,285 passengers. The number of transfer passengers is 3,597, the number of peak hour passengers is 17,988, the number of arriving and departing peak hour passengers is the same at 7,195. The 2043 terminal needs analysis is calculated based on SKEP/VI/77/2005 using the number of peak hour passengers. While the total results of the analysis of terminal space requirements at Juanda International Airport Surabaya, the area of passenger terminal facilities amounted to 53,730m2. To overcome the anticipated capacity of the number of passengers at peak hours in 2043.

Keywords : Passenger terminal capacity, Linear Regression Method, Passenger Peak time

INTRODUCTION

Juanda International Airport is one of 15 international airports managed by pt angkasa pura i covering an area of ± 605.42 ha consisting of 314.33 ha according to the cooperation agreement between pt angkasa pura i and the navy number sp.51/hk.09.01/2014/pd concerning the utilization of land and facilities of the navy for Juanda International Airport Surabaya and 291.09 ha is the utilization of land of the directorate general of civil aviation. In line with the development in east java province in sidoarjo regency and surabaya city, it is known that there is airport development which includes passengers. Towards the closing of 2022, the total growth of passengers and aircraft at juanda international airport is increasingly significant.

In 2019, terminal 1 was renovated and expanded to the east due to the increasing number of passengers and increased, after completion in 2021, now from previously having an area of 67,000m2, increased to 91,700m2. In addition, the waiting room area has also increased to 19,940m2 and has 15 departure gates from the previous 16,340m2 which had 11 departure gates, and presents a children's area or playground of two areas. It is estimated that this expansion can accommodate 13.6 million passengers.

As of 2018, the number of passenger traffic departing and arriving through Juanda Surabaya airport reached 20,951,063 million passengers per year. That figure has drastically decreased since the Covid 19 pandemic hit the city of Surabaya 6,801,099 million passengers.

The total area of the existing passenger terminal 1 area at Juanda Airport Surabaya is 91,700 m2. With the increase in the number of passengers at Juanda Airport Surabaya as one of the airports serving Hajj and Umrah flights even in 1 day Juanda airport can serve 2 to 3 flights, connectivity to potentially the terminal area cannot accommodate all passengers so that it can affect passenger comfort during peak hours. Therefore, it is necessary to calculate the area of the departure area in the terminal whether it is in accordance with the calculation standards according to SNI 03-7046-2004 and KM 20 of 2005 concerning Airport Passenger Terminal Standards.

Based on this background, the following problems can be formulated:

1. How to predict the number of passengers in 2043 using the linear regression method?
2. How is the calculation analysis of the passenger terminal area needed to accommodate passengers in 2043 using the calculation standard according to sni 03-7046-2004?

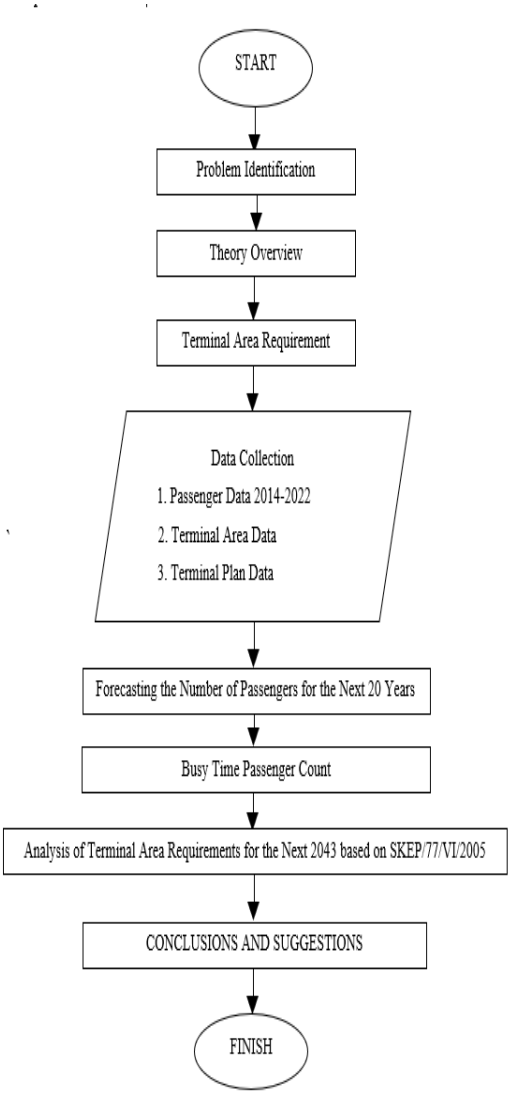
The objectives achieved are to solve the following problems:

1. To calculate the prediction of the increase in the number of passengers in the next 2043 using the linear regression method
2. To analyze the area requirement of 1 passenger terminal needed to accommodate passengers in 2043 at juanda airport, surabaya.

METHOD

In this research, the following methods were used:

1. Direct observation at juanda international airport surabaya, and supported by data obtained from the airport related to the number of passengers and the existing terminal area.
2. Literature study, which uses data obtained from books, journals, and regulations as references.



The following is the sequence of research presented in the research flow chart as below:

RESULTS AND DISCUSSION

ANALYSIS RESULT

Based on data obtained from Juanda Surabaya International Airport, the annual increase in the number of passengers from 2015 to 2018.

NO	TAHUN	PENUMPANG TERMINAL (ORANG)		JUMLAH	PERTUMBUHAN
		Datang	Berangkat		
1	2015	8.583.019	8.560.892	17.143.911	
2	2016	9.743.801	9.742.988	19.486.789	13,66 %
3	2017	10.097.219	10.030.709	20.127.928	3,29%
4	2018	10.519.214	10.431.849	20.951.063	4,08%
PENINGKATAN RATA-RATA					7,01%

From the table, Juanda International Airport shows that the average number of passengers increases every year. Passengers in 2015 were 17,143,911, increased by about 13.66% in 2016, increased by about 3.29% in 2017, increased by 4.08% from 2017 to 2018 in 2017, and passengers increased by an average of 7.01%.

To find out the development of the use of departure waiting room facilities, it is expected that the passenger movement data at Juanda International Airport can be seen in Table. An example of calculating passenger growth (passengers) from 2014 to 2018 can be seen in the following calculation.

$$\text{Total growth} = \frac{\Sigma \text{ Pax } 2018 - \Sigma \text{ Pax } 2017}{\Sigma \text{ Pax } 2017} \text{ x } 100\ \%$$

$$= \frac{20.951.063 - 20.127.928}{20.127.928} \text{ x } 100\ \%$$

$$= \frac{823.135}{20.127.928} \text{ x } 100\ \%$$

Total growth = 4.08% of Σ Pax 201

A. PASSENGER FORECASTING

The Simple Linear Regression Equation Model is used as a formula in determining the number of passenger movements both arriving and departing

for 2041. In conducting simple linear regression modeling, 2 types of applications are used, namely IBM SPSS Statistics and Microsoft Excel (Manual Calculation).

B. MANUAL PASSENGER CALCULATION

The calculation of passenger predictions for Juanda International Airport in 2043 was carried out by manual calculation using excel. Manual forecasting results are carried out with the number of passengers in the last year and the presentation of passengers. Because Juanda International Airport cannot accommodate the number of passengers up to 51.3 JPT.

Year	Manuals
2019	22,443,069
2020	23,649,328
2022	26,061,846
2023	27,268,105
2024	28,474,364
2025	29,680,623
2026	30,886,882
2027	32,093,141
2028	33,299,400
2029	34,505,659
2030	35,711,918
2031	36,918,177
2032	38,124,436
2033	39,330,695
2034	40,536,954
2035	41,743,213
2036	42,949,472
2037	44,155,731
2038	45,361,990
2039	46,568,249
2040	47,774,508
2041	48,980,767
2042	50,187,026
2043	51,393,285

C. PASSENGER CALCULATION BY SPPS SOFTWARE

SPSS is an application or software used to perform advanced statistical analysis, string analysis, data analysis using machine learning algorithms and big data analysis that can be integrated to build a data analysis platform. Among researchers and statisticians SPSS is very popularly used to help perform calculations related to data analysis.

In the SPSS application, this research uses the simple linear regression method. Simple linear regression analysis is a regression method that can be used as a statistical inference tool to determine the effect of an independent variable on the dependent variable.

Year	PWS	Coefficient	Come	Go
2019	8,977	0,04%	3,590	3,590
2020	9,460	0,04%	3,784	3,784
2021	9,942	0,04%	3,976	3,976
2022	10,425	0,04%	4,170	4,170
2023	10,907	0,04%	4,362	4,362
2024	11,390	0,04%	4,556	4,556
2025	11,872	0,04%	4,748	4,748
2026	10,810	0.035%	4,324	4,324
2027	11,233	0.035%	4,493	4,493
2028	11,655	0.035%	4,662	4,662
2029	12,077	0.035%	4,830	4,830
2030	12,499	0.035%	4,999	4,999
2031	12,921	0.035%	5,168	5,168
2032	13,344	0.035%	5,337	5,337
2033	13,766	0.035%	5,506	5,506
2034	14,188	0.035%	5,675	5,675
2035	14,610	0.035%	5,844	5,844
2036	15,032	0.035%	6,012	6,012
2037	15,455	0.035%	6,182	6,182
2038	15,877	0.035%	6,350	6,350
2039	16,299	0.035%	6,519	6,519
2040	16,721	0.035%	6,688	6,688
2041	17,143	0.035%	6,857	6,857
2042	17,565	0.035%	7,026	7,026
2043	17,988	0.035%	7,195	7,195

D. TERMINAL NEEDS ANALYSIS

In calculating the space requirements of the passenger terminal and the facilities in it, of course, require supporting data in the form of peak time passenger data arriving and departing. Based on Table 4.6, it can be seen that in 2043 the arriving peak time passengers were 7 passengers while the departing peak time passengers were 7,195 passengers. The data is then used in calculating the number of transfer passengers. As explained in SKEP 77/VI/2005 that the number of transfer passengers is equal to 20% of the

number of peak time passengers. Based on the formula, the following results are obtained.

Number of transfer passengers = Peak time passengers x 20%

Number of transfer passengers = 17,988 x 20%

= 3,598 passengers

Passenger Data	Number (Person)
Rush hour passengers	17,988
Passengers departing peak time	7,195
Passengers arrive at peak times	7,195
Peak time transfer passengers	3,598

1. Departure Hall

Referring to SKEP/77/2005, in predicting the area required for the departure hall, the following formula is used.

A = 0,75 { (11 + f) + b } + 110 %

Where: A = Departure hall area (m2)

a = number of departing passengers at peak time

b = number of transfer passengers

f = number of introducers/passengers (2 people) So obtained,

A = 0,75 { a (1 + f) + b } + 110 %

A = 0,75{7,195 (+ **2**) + 3,598} + 0,1

A= 18,887.35 m2

A = 18,890 m2

2. Departure Waiting Room

According to the Regulation of the Director General of Civil Aviation Number SKEP/77/VI/2005 concerning Technical Requirements for the Operation of Airport Technical Facilities, to calculate the Departure Waiting Room using the following calculation formula.

$A = C - (\frac{u.i+v.k}{30})\ m^2 + 10\%$

Where,

- A = Departure waiting room area
- C = number of passengers arriving at peak time
- u = Average longest waiting time (60 minutes)
- i = Proportion of passengers waiting the longest (0.6)
- v = Average fastest waiting time (20 minutes)
- k = Proportion of passengers waiting for the fastest (0.4)

$A = C - (\frac{u.i+v.k}{30})\ m^2 + 10\%$

$A = 7{,}195 - (\frac{60.0{,}6 + 20.0{,}4}{30})\ m^2 + 10\%$

A = 7,195 − (1,46) + 0,1

A = 7,193,64 m^2

A = 7,200 m^2

Based on the analysis above, according to the number of passengers arriving at peak times of 17,988 people, 7,200 m2 is needed for the Departure Waiting Room area.

3. Check - In Area

According to the Regulation of the Director General of Civil Aviation Number SKEP/77/VI/2005 concerning Technical Requirements for the Operation of Airport Technical Facilities, to calculate Check-in using the following calculation formula

$\mathbf{A = 0,25\ (a + b)m2\ (+110\%)}$

Where:

- A = Check-in area (m2)
- a = number of departing passengers at peak time
- b = number of transfer passengers

$\mathbf{A = 0,25\ (7{,}195 + 3{,}598)2(+10\%)}$

$\mathbf{A = 0,25\ (10{,}793)2 + 0.1}$

$\mathbf{A} = 2{,}698\ \boldsymbol{m2}$

$\mathbf{A} = 2{,}700\ \boldsymbol{m}2$

Based on the analysis above, according to the number of passengers arriving at peak times of 7,195 people, 2,700 m2 is needed for the Check-in area.

4. Check-In Counter

According to the Regulation of the Director General of Civil Aviation Number SKEP/77/VI/2005 concerning Technical Requirements for the Operation of Airport Technical Facilities, to calculate Check-in using the following calculation formula.

$N = (\frac{a+b}{60})$ x t1 counter (+10%)

Where,

- N = number of tables
- a = number of passengers departing at peak time
- b = number of transfer passengers (20%)
- t1 = per-passenger check-in processing time (2 minutes/passenger)

$N = (\frac{a+b}{60})$ x t1 counter (+10%)

$N = (\frac{7{,}195+3{,}598}{60})$ x 2 + 0,1

N = 359.86 unit N = 360 Unit

Based on the above analysis, according to the number of passengers arriving at peak times of 7,195 people, 360 units are needed for Check In Counter.

5. Seating

According to the Regulation of the Director General of Civil Aviation Number SKEP/77/VI/2005 concerning Technical Requirements for the Operation of Airport Technical Facilities, to calculate seating using the following calculation formula

$N = \frac{1}{3}$ X a

Where,

- N = Number of seats required
- a = Number of peak time passengers

$N = \frac{1}{3}$ X a

$N = \frac{1}{3}$ X 17,988

N = 5,996

N = 6000 seat

Based on the analysis above, according to the number of busy time passengers of 17,988 people, 6000 seats are needed for passenger seats.

6. General Facilities

According to the Regulation of the Director General of Civil Aviation Number SKEP/77/VI/2005 concerning Technical Requirements for the Operation of Airport Technical Facilities, to calculate Public Facilities using the following calculation formula.

$\mathbf{N = P\ X\ 0,2\ X\ 11m^2 + 10\%}$

- N = Number of Toilets
- P = Number of peak time passengers

$\mathbf{N = P\ X\ 0,2\ X\ 1m^2 + 10\%}$

$\mathbf{N} = 17.988\ \mathbf{X\ 0,2\ X\ 11m^2 + 0,11}$

NO	Fasilitas	Analisa Kebutuhan Terminal (2043)
1	Kapasitas Penumpang	51 Juta pax/tahun Tingkat pertumbuhan
2	Luas Hall Keberangkatan	18.890 m^2
3	Ruang Tunggu Keberangkatan	7,200m^2
4	*Check in Area*	2.700m^2
5	Fasilitas Umum	3.600m^2
6	Hall Kedatangan	14,840m^2
7	*Baggage Claim Area*	6,500 m^2
Total		53.730m^2

N = 3,597.6$\mathbf{m^2}$

NO	Fasilitas	Analisa Kebutuhan Terminal (2043)
1	*Check in Counter*	360 Unit
2	Tempat Duduk	6000 Seat

N = 3,600$\mathbf{m^2}$

Based on the analysis above, according to the number of passengers at peak times of 17,988 people, 3,600 m2 is needed for public facilities (toilets).

7. Arrival Hall

According to the Regulation of the Director General of Civil Aviation Number SKEP/77/VI/2005 concerning Technical Requirements for the Operation of Airport Technical Facilities, to calculate the Arrival Hall uses the following calculation formula.

$\mathbf{A} = \mathbf{0,375}\ (\mathbf{b} + \mathbf{c} + \mathbf{2}.\ \mathbf{c}.\ \mathbf{f}) + \mathbf{110}\%$

Where,

A = Departure hall area (m2)

- a = number of departing passengers at peak time
- b = number of transfer passengers
- c = number of arriving passengers at peak time
- f = number of escorts/passengers (2 people)

$\mathbf{A} = \mathbf{0,375}\ (\mathbf{b} + \mathbf{c} + \mathbf{2}.\ \mathbf{c}.\ \mathbf{f}) + \mathbf{110}\%$

$\mathbf{A} = \mathbf{0,375}\ (3{,}598 + 7.195 + (\mathbf{2}.\ 7{,}195.\ \mathbf{2})) + \mathbf{0}.\ \mathbf{1}$

A = 14,839.98 $\mathbf{m^2}$

A = 14.840$\mathbf{m^2}$

Based on the analysis above, according to the number of passengers at peak times of 17,988 people, 14,840 m2 is needed for the Arrival Hall.

8. Bagage Claim

According to the Regulation of the Director General of Civil Aviation Number SKEP/77/VI/2005 concerning Technical Requirements for the Operation of Airport Technical Facilities, to calculate the Baggage Claim Area using the following calculation formula.

$\mathbf{A} = \mathbf{0,9\ c} + \mathbf{110}\%$

Where:

- A = Baggage claim area (m2)
- c = number of passengers arriving at peak time

$\mathbf{A} = \mathbf{0,9\ c} + \mathbf{110}\%$

$\mathbf{A} = \mathbf{0,9}\ (7{,}195) + \mathbf{0,1}$

A =6,475.5$\mathbf{m^2}$

A = 6,500$\mathbf{m^2}$

Based on the analysis above, according to the number of passengers departing at peak times of 7,195 people, 6,500 m2 is needed for the Baggage Claim Area.

E. Conditions of the estimated Development plan

Based on the results of the calculation of the area required at Juanda Surabaya International Airport for the year 2043, it is necessary to expand and propose the shape of the airport to support airport passenger activity facilities.

CONCLUSION

Based on the results of the analysis of passenger forecasting and space requirements for the Juanda Surabaya Airport terminal, it can be concluded as follows:

1. For the prediction of passenger forecasting in 2043, amounting to 51,393,285 pax.
2. While the results of the analysis of terminal space requirements at Juanda International Airport Surabaya, the area of passenger terminal facilities amounted to 53,730m2.

Suggestion

It is recommended that Juanda Airport can carry out development or expansion on an ongoing basis in accordance with the predicted amount of passenger growth with a sufficient amount of land location area to improve passenger services, and in the future it is hoped that this research will be equipped with a design and calculation of a cost budget plan.

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