Air Side Facilities Planning for Terminal 3 Juanda Airport, Surabaya

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Abstract— Juanda Airport experiences a very rapid increase in the number of passengers from year to year, this has an impact on the increase in aircraft movements which causes delays. To overcome this problem PT. Angkasa Pura I will develop Juanda airport by building Terminal 3 which is targeted to serve up to 75 million passengers. However, the construction of Terminal 3 needs to be equipped with detailed planning of airside facilities which include runway, exit taxiway, taxiway, and apron. This detailed planning will consider aircraft movements when the airport is fully operational to avoid delays. In planning the airside facilities at Terminal 3, air traffic movement data was collected from 2009 to 2016 to predict the planned target number of passengers. From the results of the analysis carried out, the number of passengers reaching this target occurred in 2031 with the number of aircraft movements per year being 414,727. The aircraft planned for this plan is the Boeing 737 Max 8 aircraft which is a new generation of Boeing 737-800 type aircraft, which is the aircraft with the maximum movement results in 2031. And aircraft movements during peak hours in 2031 will reach 61 movements/hour. This number of movements is obtained from a simulation of aircraft movements in the planning year. After calculating the runway capacity, it was found that 2 runways were needed to serve aircraft movements at Terminal 3 Juanda. The maximum runway capacity that can be generated with the composition of aircraft classes operating in Juanda is class B: 10%, C: 20%, and D: 70%. In planning this airside facility, it is also calculated that it can serve large aircraft such as the A380. So, the runway length is 3900 m with a runway width of 86 m including the runway shoulder. The dimensions of the taxiway are 30 m including a shoulder width of 15 m on each side. The location of the exit taxiway along 2770 is measured from both ends of the runway at an angle of 300, and the area of the apron with pier (finger) type is 1,000,000 m2.

Keywords— Airside, Runway, Taxiway, Exit Taxiway Apron, Terminal 3 Juanda.

I. INTRODUCTION

Juanda Airport has become the pulse of air transportation in the city of Surabaya, serving domestic and international flights. Apart from that, this airport is also an international airport in Indonesia.

has the busiest international flight activity and is the second busiest after Soekarno Hatta airport. However, currently Juanda is considered to have exceeded capacity (over capacity), this is because the capacity of Terminal I and Terminal II Juanda can only accommodate around 12.5 million passengers per year, while the number of passengers currently reaches 17 to 25 million per year. The increase in the number of passengers from year to year also influences the increase in aircraft movements. However, this busy flight can result in an even tighter schedule which makes it easier for delays to occur. For this reason, PT. Angkasa Pura I will carry out development.

The construction of Terminal 3 is expected to become the 2nd largest airport in Indonesia and the leading airport in Southeast Asia. When fully operational, Terminal 3 of Juanda Airport is targeted to be able to accommodate up to 75 million passengers per year. In facilitating passenger growth at Juanda Airport, it is necessary to plan airside facilities at Terminal 3 which include runway, taxiway, exit taxiway and apron. Where detailed planning of these airside facilities helps aircraft move efficiently, so that aircraft using the runway can leave the runway to the apron as quickly as possible, and vice versa. This detailed plan will consider aircraft movements when the airport is fully operational. To avoid delays due to inadequate airside planning, this final project was prepared.

In preparing this final assignment, it is necessary to have a forecasting process for the number of aircraft movements which are estimated to serve 75 million passengers. The process of forecasting and converting the number of passengers into types of aircraft in operation will also be discussed in this final assignment.

The objectives of this final project planning are as follows:

1. Know the results of forecasting the number of movements and types of aircraft operating at peak hours at terminal 3 of Juanda airport.
2. Know the dimensions of runway planning to serve aircraft movements during peak hours at Terminal 3 of Juanda Airport.
3. Know the dimensions of taxiway planning to serve aircraft movements during peak hours at Terminal 3 of Juanda Airport.
4. Know the exit taxiway planning dimensions and angles to serve aircraft movements during peak hours at Terminal 3 of Juanda Airport.
5. Know the dimensions of an apron planning to serve aircraft movements during peak hours at Terminal 3 of Juanda Airport.

II. METHOD

The research flow diagram is displayed in Figure 2.

III. RESULTS AND DISCUSSION

A. Analysis of Existing Conditions

1. Aircraft Movement

This aircraft movement data is needed for airside planning. Aircraft movement data at Juanda airport was taken from

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Fig 1. Layout of the planning location for Juanda Terminal 3(Source: PT Angkasa Pura 1)

aircraft movements for a week starting from March 19, 2017, to March 25, 2017 (look at table 1). From the movement schedule, we can obtain the types of aircraft operating in Juanda (look at table 2).

2. Peak Hour Calculation

Peak hour calculations are carried out on that date by finding the maximum value of the number of aircraft movements in one hour or 60 minutes. The following are some of the total aircraft movements obtained on February 20, 2017 (Peak day). This percentage is used to calculate peak hours in the plan year assuming the same percentage as existing conditions.

3. Forecasting

This forecasting uses regression methods, both linear, logarithmic, exponential, and polynomial. After forecasting using various regressions, we obtained the results of forecasting aircraft movements in 2016 which are closest to historical data in 2016 using regression exponential, as well as forecasting passenger movements. So, using exponential regression, we can get the results of forecasting passenger movements that are close to 75 million passengers occurring in a year2031 the forecasting results can be seen in table 5.

4. Estimation Movement Aircraft in Year 2031

Movement data for each type of aircraft is obtained by multiply percentage on table 2 to total movement each type aircraft with movement aircraft annual in year 2031 on table 5. So that can generate movement aircraft (look at table 6). Meanwhile, the estimated characteristics of aircraft movements in 2031 can be seen in table 7.

5. Estimated Aircraft Movements during Rush Hours in 2031

Estimated movement during peak hours (peak hour) is by multiplying the peak hour percentage (peak hour) against the daily movement of 2017 in table 4 with the daily movement of 2031. To obtain daily movement data in 2031 is obtained by dividing the annual movement of 2031 by 365 (1 year = 365 days). The daily movement in 2031 is 443,576/365 = 1136.

6. Aircraft that will be served at Terminal 3

In table 8, the number of aircraft movements during peak hour at Juanda airport in 2031 is 83. Based on the information obtained, runway 1 at Juanda can ideally serve up to 22 aircraft movements per hour. So, the movement of aircraft to be served at terminal 3 is 83-22 =61 movements/hour.

7. Runway Capacity Calculation

This runway capacity calculation was carried out by looking

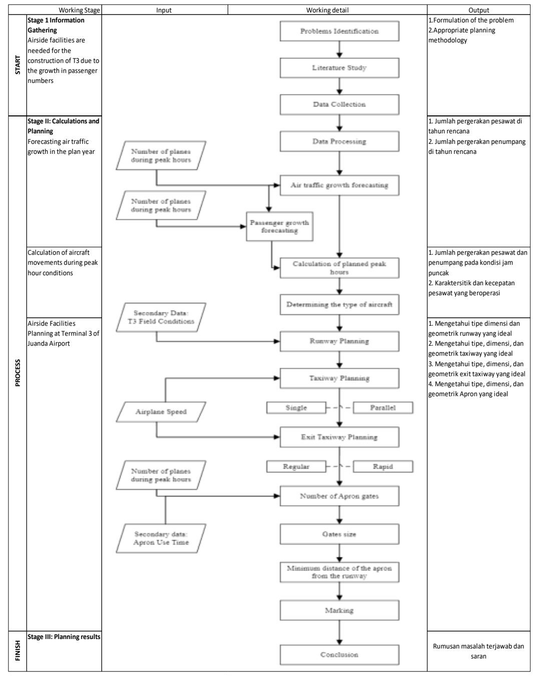

Fig 2. Diagram Flow Planning

at the number of aircraft movements during peak hours in 2017 to optimize runway use in 2031.

The mix of aircraft and their characteristics can be seen in the following table. Aircraft categories are classified based on landing speed according to Federal Aviation Administration (FAA) regulations [1]. Usage time runway (Ri) and approach speed (approach speed) is the average value for each aircraft category taken from Zadly Andi's Final Project (2010) [2].

a. Arrival Just

- Circumstances Free Error

- Close condition

Formula: $T_{ij} = T_j - T_i = \frac{\delta ij}{V_j}$

For Vc = 128 knots And Vd = 145 knots got,
T_{CD}= 3/145 x 3600 = 74.48 second
For Vb = 120 knots And Vc = 128 knots got,
T_{BC} = 3/128 x 3600 = 84.37 second
For Vb = 120 knots And Vd = 145 knots got,
T_{BD} = 145 x 3600 = 74.48 second

Circumstances stretched formula:
$T_{ij} = T_j - T_i = \delta ij / V_i + \gamma\ (1/V_j - 1/V_i)$
For Vd = 145 knots And Vc = 128 knots got,
T_{DC} = 3/145 (3600) + 8 (1/145 - 1/128) (3600) = 100,86 second
For Vd = 145 knots and Vb = 120 knots got,
T_{DB} = 3/145 (3600) + 8 (1/145- 1/120) (3600) = 115.86 second
For Vc = 128 knots And Vb = 120 knots got,
T_{CB} = 3/128 (3600) + 8 (1/120 - 1/128) (3600) = 99,375 second

The situation is the same Formula:
$T_{ij} = T_j - T_i = \delta ij / V_j$
For Vi = Vj = 120 knots got,

TABLE 1.

Movement aircraft during a week in Juanda

Date	Domestic		International		Total
	Departure	Arrivals	Departure	Arrivals	
19-Feb-17	214	218	32	30	494
20-Feb-17	218	220	31	29	498
21-Feb-17	216	219	29	28	492
22-Feb-17	229	214	23	32	497
23-Feb-17	219	213	30	29	491
24-Feb-17	216	217	31	18	482
25-Feb-17	215	211	30	32	488
Total	1527	1512	206	198	3443
Percentage (%)	44.35	43.92	5.98	5.75	100

TABLE 2.

Movement aircraft during a week in Juanda

Type aircraft	Amount movement	Group	Percentage of total movement (%)
Airbus A320	840	III	24.48
Airbus A321	4	III	0.12
Airbus A330-300	161	IV	4.69
Airbus A330-200	45	IV	1.31
Airbus A319	6	III	0.17
Airbus A318/A319/A320/A321	60	III	1.75
Boeing 737-100	15	III	0.44
Boeing 737-800	977	III	28.47
Boeing 737-900	794	III	23.14
Boeing 737-500	78	III	2.27
Boeing 737-400	1	III	0.03
Boeing 737-300	98	III	2.86
ATR 12-300/320	177	II	5.16
ATR 72	84	II	2.45
Canadair	85	II	2.48
ATR 42-300/320	7	II	0.20
Total	3432		

T_{BB} = 3/120 (3600) = 90 second
For V i = V j = 128 knots got,
T_{CC} = 3/128 (3600) = 84,375 second
For V i = V j = 145 knots got,
T_{DD} = 3/145 (3600) = 74,48 second

so will generated separation time minimum in threshold runways for all circumstances as following table 10. Meanwhile, the percentage of combinations [Pij] that occur in the mixture can be seen in table 11. With thereby capacity system runways for serve just come

C = 1/E(Tij)
= 1/145.41 (3600) = 19 operations/hour

b. Departure only

Matrix percentage combination [Pij] Which happens in mixture can be seen on table 12.

Time service between departure on the verge runways E(nd) obtained from tower ATC Juanda:

E[Tij] = Σ $[p_{ij}]$ $[M_{ij}]$
E[Tij] = 120 second

So, runway capacity Which only serve departure just obtained on equality following:

TABLE 3.

Example amount movement aircraft per O'clock in Juanda

Intervals Time	Arrivals	Departure	Total	Percentage to movement daily (%)
6.00 AM - 6.59 A.M	22	7	29	5.82
7.00 AM - 7.59 A.M	16	17	33	6.63
8.00 AM - 8.59 A.M	20	8	28	5.62
9.00 AM - 9.59 A.M	18	18	36	7.23
10.00 AM - 10.59 A.M	15	14	29	5.82

TABLE 4.

Details movement aircraft moment peak hour

	Domestick		Interna sional	
	Departmen t	Arr	Departm ent	Arr
Movement Moment Peak Hour	15	13	3	5
Total Movement Daily	498			
Percentage Peak Hour To Total Movement Daily (%)	3.01	2.61	0.60	1.00

TABLE 5.

Results Forecasting Movement So Cross in Year 2031

Phase	Year 2031
Movement Passenger	77,564,298
Movement aircraft	414,727

TABLE 6.

Estimation Movement Aircraft in year 2031

Tipe pesawat	Presentase terhadap total pergerakan (%)	Jumlah Pergerakan
Airbus A320	24.48	101,507
Airbus A321	0.12	483
Airbus A330-300	4.69	19,455
Airbus A330-200	1.31	5,438
Airbus A319	0.17	725
Airbus A318/A319/A320/A321	1.75	7,250
Boeing 737-100	0.44	1,813
Boeing 737-800	28.47	118,062
Boeing 737-900	23.14	95,948
Boeing 737-500	2.27	9,426
Boeing 737-400	0.03	121
Boeing 737-300	2.86	11,842
ATR 12-300/320	5.16	21,389
ATR 72	2.45	10,151
Canadair	2.48	10,272
ATR 42-300/320	0.20	846
Total	0.2	829

C = 1/E[Tij]
= 1/120 (3600) = 30 operations/hour

c. Operation Mixture

Step final Which done for determine Runway capacity is by finding possibility did its departure (departures) between two arrivals (arrivals). Time usage runway average E[Ri], is the number of multiplications of percentage category aircraft with time usage runways each category aircraft. The size mark percentage This can be seen in table 9, so that it is obtained.

E[Ri] = 0.00 (62) + 0.61(67.4) + 0.39(64.5)
= 66.27sec

Time Which expected aircraft Which come for go through distance 2 miles final to threshold runways is:

E[$\delta d/Vj$] = [0,00 (2/120) + 0,61 (2/128) + 0,39 (2/145)] (3600)

TABLE 7.

Estimation Character Movement Aircraft year 2031

Phase	Total	Domstic		International	
		Departure	Arrival	Departure	Arival
Presentage of Aircraft Movement (%)	100	44.351	43.915	5.983	5.751
Number of aircraft movement	414,727	183,935	182,128	24,814	23,850

TABLE 8.

Estimated Aircraft Movements during Peak Hours of the Year 2031

	Domestic		Internas ional	
	Depart	Arr	Depart	Arr
Total	1136			
Total Percentage of Peak Hours Against Daily Movement (%)	7.23			
Percentage of Hourly Packs Against Daily Movement (%)	3.01	2.61	0.60	1.00
Total Movement During Peak Hour (movements/hour)	82.14			
Movement During Peak Hour (movements/hour)	34	30	7	11

TABLE 9.

Characteristics of aircraft mix at Peak hour on February 20, 2017

Type Aircraft	Landing Speed (knot)	Take Off Speed (knot)	Time Usage Runway (seconds)	ercentage	
				Arrivals	Departures
B	120	110	62	0	6
C	128	139	67,4	61	33
D	145	145	64,5	39	61

TABLE 10.

Error Free Matrices

		Leading (i)		
		B	C	D
Trailing (j)	B	90.00	99.38	115.86
	C	84.38	84.38	100.86
	D	74.48	74.48	74.48

TABLE 11.

Error Free Matrices

		Leading (i)		
		B	C	D
Trailing (j)	B	0	0	0
	C	0	0.22	0.17
	D	0	0.22	0.11

= 53,68 second

E[td] = 186 second

E[Bij] = 20 (1,28) = 25,6 second

So that for count possibility something operation departure (departures) can done in between two operation arrival (arrivals) use equality as follows:

E[Tij] > E[Ri] + E[$\delta d\ Vj$] + E[Bij] + (n -1) E[Td]

E[Tij] > 66,27 + 53,68 +25,6 + (n -1) 186

E[Tij] > 145,55+ (n-1) (120) second

Because of the values in the intertime matrix arrival [Mij] No

TABLE 12.

Matrix percentage combination [Pij]

		Leading ( )		
		B	C	D
Trailing (j)	B	0	0	0
	C	0	0.11	0.17
	D	0.06	0.11	0.28

TABLE 13.

Simulated Percentage Variations

No.	Present		
	B	C	D
1	0,1	0,2	0,7
2	0,1	0,3	0,6
3	0,2	0,3	0,5
4	0,1	0,4	0,5

TABLE 14.

Parallel Runway Capacity Simulation 1

No	Present			Capacity		
	B	C	D	Arrival Only	Departure Only	Mixed
1	0,1	0,2	0,7	41	37	38
2	0,1	0,3	0,6	36	35	36
3	0,2	0,3	0,5	34	38	37
4	0,1	0,4	0,5	37	37	37

TABLE 15.

Parallel Runway Capacity Simulation 2

No	Present			Capacity		
	B	C	D	Arrival Only	Departure Only	Mixed
1	0,1	0,2	0,7	44	38	39
2	0,1	0,3	0,6	39	37	36
3	0,2	0,3	0,5	36	35	36
4	0,1	0,4	0,5	40	36	36

bigger from 145.55 second, so values smaller than that will be changed to 145.55 seconds so that one departure can be made at between two arrivals.

So, the runway capacity for mixed operations is calculated using formula following:

C = 1/E[Tij] (1+Σnd.pd)

= 1/145 (1+3(0.08) + 2(0.027) + 1(0.083) + 4(0.027)

= 37 operation/hour

8. Simulation Capacity Runways

Process simulation This done for determine maximum

TABLE 16.

Total Simulation Results for Runway Capacity 1 and 2

No	Present			Capacity		
	B	C	D	Arrival Only	Departure Only	Mixed
1	0,1	0,2	0,7	85	75	77
2	0,1	0,3	0,6	75	72	72
3	0,2	0,3	0,5	70	73	73
4	0,1	0,4	0,5	77	73	73

TABLE 17.

Distance from Runway End to Touchdown Point (D1) and Point Distance Touchdowns to location exit taxiway (D2)

Category Aircraft	D1	D2		
		30	45	90
A	166.04	328.30	502.45	622.1679
B	857.36	508.90	683.05	802.7637
C	902.75	937.58	1111.73	1231.444
D	1348.45	1388.95	1563.10	1682.818
E	268.21	1641.93	1816.08	1935,793
F	613.85	1392.74	1566.89	1686.606

TABLE 18.

Distance from Runway End to Touchdown Point (D1) and Point Distance Touchdowns to location exit taxiway (D2) corrected.

No	Present			Capacity		
	B	C	D	Arrival Only	Departure Only	Mixed
1	0,1	0,2	0,7	41	37	38
2	0,1	0,3	0,6	36	35	36
3	0,2	0,3	0,5	34	38	37
4	0,1	0,4	0,5	37	37	37

capacity on the runway by changing composition each – each category aircraft until found amount movement aircraft biggest in 1 hour period which includes capacity calculations for arrival only, departure only (departure only) And operation mixture (mixed). This simulation calculation will be run using a program helped Microsoft Excel with formula random number. Process simulation done two times for find capacity two parallel runways (look at the table 13).

Results calculation capacity runways for arrival just (arrivals only), arrival just (departures only), And mixture (mixed) which use compositions category aircraftother summarized on table 14 and 15.

From the two total runway capacities above then added up. Calculation simulation with use percentage composition category aircraft dominant D obtained the maximum parallel runway capacity for arrivals only amounting to 85 operations per hour, departure just (departure only) as big as 75 operation per hours, and mixed operations amounted to 77 operations per O'clock with composition, B: 10%, C: 20%, And D: 70%.

TABLE 19.

Distance Total from End Runway to Location Exit Taxiway (S)

No	Present			Capacity		
	B	C	D	Arrival Only	Departure Only	Mixed
1	0,1	0,2	0,7	85	75	77
2	0,1	0,3	0,6	75	72	72
3	0,2	0,3	0,5	70	73	73
4	0,1	0,4	0,5	77	73	73

TABLE 20.

Amount Gate Based on Code Letters Aircraft

Category Aircraft	D1	D2		
		30	45	90
A	166.04	328.30	502.45	622.1679
B	857.36	508.90	683.05	802.7637
C	902.75	937.58	1111.73	1231.444
D	1348.45	1388.95	1563.10	1682.818
E	268.21	1641.93	1816.08	1935,793
F	613.85	1392.74	1566.89	1686.606

TABLE 21.

Characteristics Aircraft on Planning Aprons

No	Present			Capacity		
	B	C	D	Arrival Only	Departure Only	Mixed
1	0,1	0,2	0,7	41	37	38
2	0,1	0,3	0,6	36	35	36
3	0,2	0,3	0,5	34	38	37
4	0,1	0,4	0,5	37	37	37

9. Planning Geometric Side Air

a. Runway

Runway geometric planning [3] This aircraft uses the planned Boeing 737 Max 8. However, it is intended that the runway at Terminal 3 of Juanda Airport can meet the geometric requirements for all types of aircraft that will operate on this runway, so the largest aircraft that is planned to operate on this runway is taken, namely the Airbus aircraft. A380, which is included in code 4F. The following is data on the condition of the Ngurah Rai field for calculating corrections which are assumed to be the same as the condition of Juanda airport:

Elevation above the face water sea : 4.27 m

Temperature Reference : 28ºC

Correct to elevation, **Fe**:

Fe = 1 + 0,07 (*h*/300) = 1 + 0,07 (4,27/300) = 1,000996

Correct towards temperature, **Ft**:

Ft = 1+ 0.01 (Q – (15 – 0.0065*h))

= 1+ 0.01 (28 – (15 – 0.0065*4.27)) = 1.130278

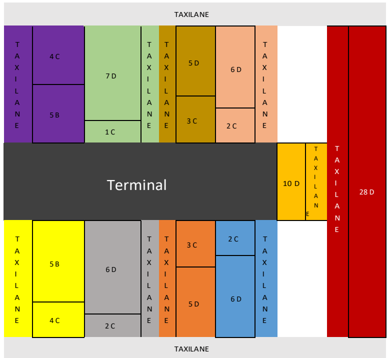

Fig 3. Distribution Areas in Planning Aprons

From the correction calculation above, the corrected runway length is,

$$ARFL = \frac{Lro}{Fe \times Ft \times Fs}$$

$$3048 = \frac{Lro}{1{,}000996 \times 1{,}130278 \times ...s}$$

Lr_0 = 3448,52 m

Whereas the runway length requirement for landing in wet conditions is:

Actual landing distance x 1,92 = 2020 x 1,92 = 3859,2 m Up to the length of the runway used is 3900 m.

a) Runway width
Obtained runway width dimensions[4] Airbus A380 group VI aircraft andapproach category C is 200 ft or about 61 m

b) Runway Shoulder
The runway shoulder for group VI F aircraft is 12.5 m with a maximum shoulder slope of 2.5%.

c) Blastpad/Stopway
The dimensions of the blastpad are 60 m long and 45 m wide with slope 0.3% each 30 m. For dimensions clearway, no more than half the length take off run Which There is and wide as big as 150 m as well as the slope No can more from 1.25 %.

d) RESA (Runway End Safety area)
RESA dimensions based on the table for code letter F is 90 m for the minimum length, while the RESA width cannot be less than twice the width of the existing runway.

b. Taxiways

a) Dimensions Taxiways
The required taxiway width is 30 m and the minimum clearance from the outer edge of the main wheel to the edge of the taxiway is 4.5 m.

b) Taxiway Shoulder
The minimum shoulder width is 60 m. This width is included in the width taxiway, up to shoulder width taxiway each side is found to be 15 m.

c) Fillet Taxiway
Round value taxiway (R) is 45 m, length from transition to fillet (L) is 75 m, width from and out taxiway 18m and from the radius table fillet the value of the bend radius of side t is obtained taxiway and runway as R1 = 60 m, R2 = 60 m, r0 = 75 m, r1= 45 m, and r2 = 50 m. (Source: SKEP 77-VI-2005).

d) Exit Taxiway
Planning exit taxiway this is calculated for all plane categories and angles. Example of calculating tip distance runway the exit taxiway for angular category D aircraft exit taxiway 30^0.
V ot = 85 m/s
V td = 71.94 m/s
Ve = 30.87 m/s
a_1 = 0.76 m/s²
a_2 = 1.52 m/s²

Distance from end runways to point touchdowns:

$$D1 = \frac{Vot^2 - Vtd^2}{2a1} = \frac{85^2 - 71{,}94^2}{2(0{,}76)} = 1348{,}45 \text{ m}$$

Distance from the touchdown point to the taxiway exit location:

$$D1 = \frac{Vtd^2 - Ve^2}{2a2} = \frac{71{,}94^2 - 30{,}87^2}{2(1{,}52)} = 1388{,}95 \text{ m}$$

Point distance touchdown theexit taxiway a correction factor must be added [5] elevation and temperature.

Factors correct = $1 + 0.03 \frac{4{,}27}{300} = 1{,}000427$

Factors correct = 1+ [(28-15)/5,6] x 1% = 1,02321

Then the results of the correction calculation for D_2 is:

D 2 = 1388,95 x 1,000427 x 1,02321 = 1421,8 meters

Distance end runways to exit taxiway become:

S = D 1 + D 2 = 1348,45 + 1421,8 = 2770,24 meters

Calculation results of the total distance from the end of the runway to the location exit taxiway for each aircraft category can be seen in table 17-19.

The exit taxiway angle used is angle 300, so that the minimum exit taxiway distance used in this planning is 2770 meters measured from both ends of the runway.

c. Apron

In the geometric planning of the terminal 3 apron area, the required number of aircraft movements during peak hours in 2031 is 61 movements/hour. And it is planned with a movement percentage for each aircraft category B: 10%, C: 20%, and D: 70%. Then we get the number of gates needed with the equation:

$$D1 = \frac{V \, x \, T}{U} = \frac{61 \, x \, (0{,}8/60)}{0{,}8} = 104 \text{ m}$$

The number of gates for each aircraft category based on percentage can be seen in table 20. Characteristics aircraft Which needed in planning aprons can be seen in table 21. Radius calculation example for aircraft category B can be calculated using equation below:

Category B

R = (wingspan/2) + (wheelbase/tg60)
= (27/2) + (10,77/tg60) = 19,72

To make it easier to calculate the area of the apron, then aprons shared become eight areas. Distribution areas can be seen on picture under This Which differentiated with color.

An example of area calculation is as follows:

a) Yellow Area

Consists of 5 pieces parking stand category B aircraft, 4 pieces parking stand category C aircraft and a taxi lane. The formula for calculating the area is as follows:

i) 5 parking stands B

P = G x 2R + (G+1) x C

= 5x2(19.7) + (5+1) x 3

= 215.18 m L= L + c + W

= 27.16 + 3+ 48.76

= 78.92 m

L = L + c + W

= 27,16 + 3+ 48,76

= 78,92 m

ii) 4 parking stand C

P = G x 2R + (G+1) x C

= 4x 2(25,19) + (4+1) x4.5

= 224.08 m L= L + c + W

= 37.57 + 4.5 + 88.39

= 130.46 m

L = L + c + W

= 37,57+ 4,5 + 88,39

= 130,46

So that wide Areas color yellow is:

L = P x L

= (215.18+ 224.08) x 130.46 = 57,306 m^2

Then proceed with calculations for other areas, and get a total apron area of:

Apron Area = Yellow Area Area + Gray Area + Blue Area + Purple Area + Green Area + Pink Area + Area Orange + Broad Red

= 57.306 + 80,049 + 60.864 + 80.049

+57.306 + 80.573 + 60.864 + 80.049 +

76.053+ 211.200 + 123.334

= 967.647 m^2

10. Markings and Signs

After carrying out calculations for the geometric planning of the airside facilities, then proceed with the runway marking [6].

IV. CONCLUSION

1. Conclusion

The things that can be concluded from the results of the analysis of calculations and planning in this Final Project include the following:

a) From data on air traffic movements operating at Juanda Airport in Surabaya, the results obtained are forecasting that the number of passengers approaching 75 million passengers will occur in 2031, amounting to 77,564,298 passengers, and total aircraft movements in that year amounting to 414,727 movements. From the results of the planned peak hour calculation of total movements in 2031, it was obtained that it was 61 movements/hour.

b) In calculating runway capacity, it was found that the runway at Juanda is currently unable to handle the number of movements that occur. Because the calculation results show that the current runway capacity to serve arrivals alone is 19 operations/hour, the runway capacity to serve departures alone is 30 operations/hour, and the runway capacity to serve mixed operations is 37 operations/hour. So, it is needed runway parallel which operates at terminal 3 Juanda to serve aircraft movements operating for 75 million passengers.

c) To maximize the use of parallel runways at Terminal 3 Juanda, results were obtained from capacity simulations runway parallel for arrival only required to park aircraft at terminal 3 with apron pier (finger) type is 967,647 m^2.

2. Suggestion

The limited time available meant that the work on this Final Project did not produce optimal results. This final assignment can still be developed further as follows:

a) Runway capacity simulation calculations can still be developed by varying the percentage of aircraft categories without dominating one aircraft category.

b) In airside geometric planning, this planning uses aircraft categories based on capacity simulation results, namely categories B, C and D so that it can be developed by considering other categories of aircraft.

c) The apron planning uses length estimates based on the length of the terminal which is not calculated in detail. So, it can still be developed so that the apron area is more in line with needs.

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