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The Optimization of Apron Capacity in Blimbingsari Banyuwangi Airport

Fatmawati Sabur
Lecturer, at Department of Telecommunications and Air Navigation Engineering, Aviation Safety Academy, Makassar 90241-90243, Indonesia
E-mail:fatmawati.sabur.fs@gmail.com

Abstract: *Blimbingsari Banyuwangi Airport serves several flying schools in Indonesia besides serving domestic flights. The traffic movement has increased which has an impact on the density of traffic so that the movement of the apron cannot be avoided. The research aims to increase apron capacity towards the smooth flow of flight traffic at Blimbingsari Banyuwangi Airport. Using descriptive qualitative and quantitative methods based on observations in the field about apron dimensions, number of parking booths, parking configuration and parking duration. The results show that traffic is disrupted when a plane is holding on a taxiway, thus triggering a delay. Airlines experience loss of time and fuel, so that the apron is not optimally utilized, alternative solutions are suggested to expand the apron, and rearrange the layout of the aircraft while parking.*

Keywords: *Apron capacity, parking stand, slot time*

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I. Introduction

Organizing air transportation as one of the tasks of the government, has 2 (two) sides which must be considered, namely the effective implementation of air transportation in the sense of being able to reach all regions of Indonesia and opening isolation to support regional economic growth, while the other side organizing air transportation must be carried out in an efficient in order to reduce the burden on the government and can be sustainable.

Utilization of Blimbingsari Airport can be used for take off and landing [1]. Blimbingsari Airport currently serves three flying schools, namely the Bali International Flight Academy (BIFA), Mandiri Utama Flight Academy (MUFA) [2], and the Banyuwangi Aviation and Training Centre (BATC), also serves 3 (three) airlines for flights commercially operated by Garuda Indonesia, Wings Air and currently Nam Air (Boeing 737-500) has begun operating. With a total traffic reaching 150 to 200 aircraft movements per day including Traffic Departure, Arrival, Overflying, Cross Country, and Local Flight including the Training Circuit and Training Area. Therefore, in providing airport services, quality must be as much as possible, as well as providing information on flight operations for the sake of creating safety [3,4].

The movement of the training aircraft triggers an increase in the amount of traffic at Blimbingsari Airport in Banyuwangi, so that demands for an increase in safe and efficient services in serving traffic flow in the ground movement [4]. When there is traffic density, the apron configuration is divided into: Main Apron (capacity of 4 aircraft units) and New Apron (capacity of 4 aircraft units) [5], as shown in Figure 1.

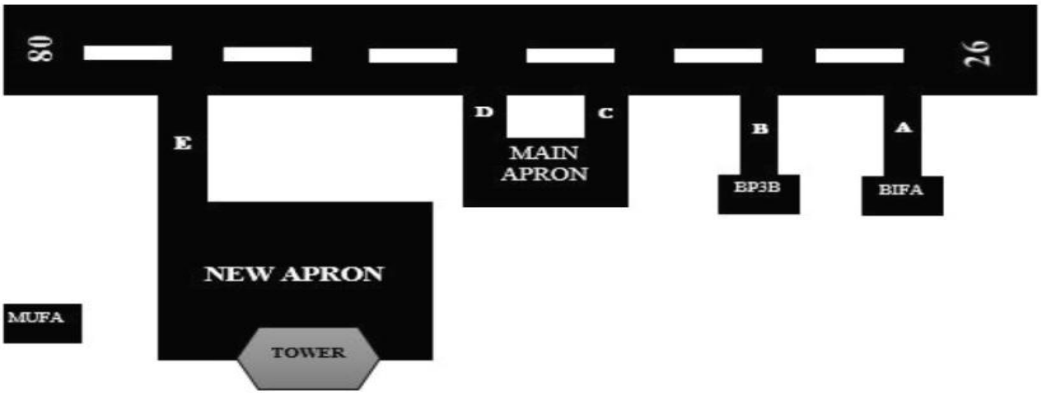

Figure 1. Blimbingsari Airport Layout

II. Methodology

This research is a non-experimental research in the form of case studies of air traffic services [6]. This study uses descriptive and qualitative methods through the study of primary time holding position data in taxiways, apron dimensions, and number of parking stands, parking configuration, duration and aircraft parking accumulation at Blimbingsari Banyuwangi airport apron.

Method of Collecting Data

Primary data is obtained through recording aircraft movements from touchdown, exit from runway or runway clear, holding in taxiway, parking time, stand parking position, parking duration, and parking accumulation. Whereas Secondary Data are sourced from aerodrome documents, dimensions of air side facilities (runway, taxiway, and apron) Slot time, Standard Operational Procedure [7,8,9] and aircraft movements during the past year Blimbingsari Airport, Banyuwangi.

Data processing

Data processing is carried out in a description and analysis of primary data to determine the parking index, parking duration, and accumulation of parking at peak hours compared to the available apron capacity [8] and the specified slot time. Based on these calculations an optimal parking capacity is obtained.

Data analysis

Data analysis is based on the number of aircraft movements over the past 5 (five) years by observing the movement/utilization of the apron area, especially the Main Apron and New Apron [10] which is one factor in the delay for the type of aircraft operating at Blimbingsari Airport, due to the delay prolonged.
Calculate the fuel losses incurred by airlines based on parking duration according to parking index data and parking accumulation, and then adjust the available slot time so as to create a smooth flight movement

III. Discussion

Traffic Movement Data

The number of aircraft movements operating at Banyuwangi Airport over the past five years can be seen in Table 1.

Table 1. Traffic Movement

Year	Traffic Movement	Growth (%)
2013	714	-
2014	1.687	1,36 %
2015	1.838	0,09 %
2016	2.363	0,29 %
2017	3.049	0,29%
Average growth (%)	1930,2	0,51 %

Source: PT. Angkasa Pura II, 2017

The movement of the amount of traffic over the last five years there was a significant increase with an average of 0.51% caused by the increase in the number of aircraft or passengers.

Table 2. Characteristics of aircraft

Type aircraft	Code	MTOW (kg)	wings span (m)
B737-500	4C	60555	28,9
ATR72-500	3C	22500	27
ATR72-600	3C	22800	27,5
Bombardir CRJ 1000	3C	41640	26,19

Source: Airport Planning and Design, Horonjeff 1983, ICAO) [11,12]

Based on data from the types of aircraft operating at Banyuwangi Blimbingsari Airport, commercial aircraft types Boeing 737 500 series with reference code C and wingspan 28.9 meters according to the Ministry of Transportation regulation No. 39 of 2015, used as a basis for planning parking stands at Main Apron and New Apron. Airport layout can be seen in Figure 2.

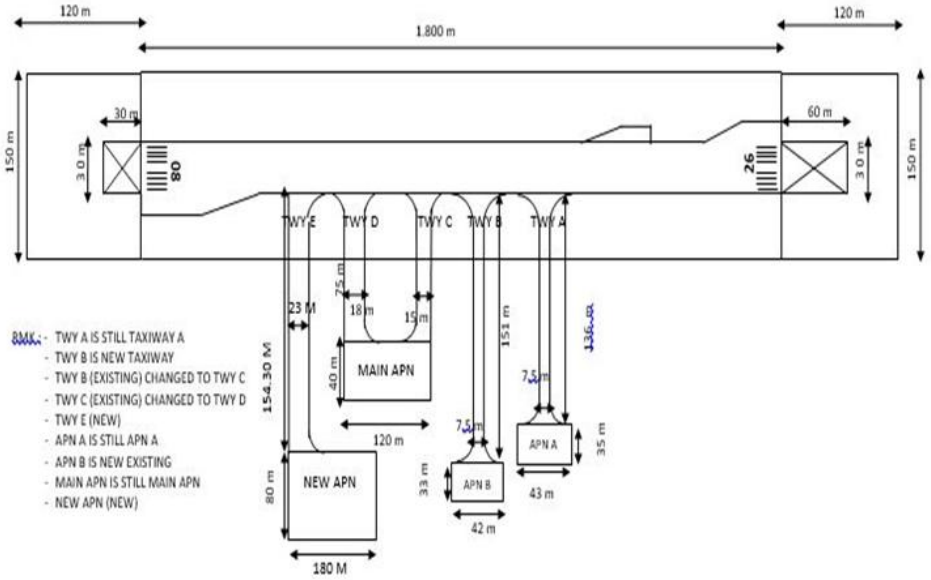

Figure 2. Blimbingsari Banyuwangi Airport Layout

Based on AIP Indonesia, the apron condition of Blimbingsari Banyuwangi Airport can be seen in Table 3.

Table 3. Data Surface and Strength Apron

Name Apron	Surface	Strength	Dimension
Main Apron	Asphalt	PCN 21/F/C/Y/T	120 x 40 m
Apron A	Asphalt	2400 lbs	35 x 43 m
Apron B	Concrete	PCN 13/R/C/Y/T	33 x 42 m
New Apron	Concrete	PCN 61/R/C/W/T	180 x 80 m

Source: Research Data, 2019

The main apron and new apron configuration of Banyuwangi Airport can be seen in Tables 3 and 4.

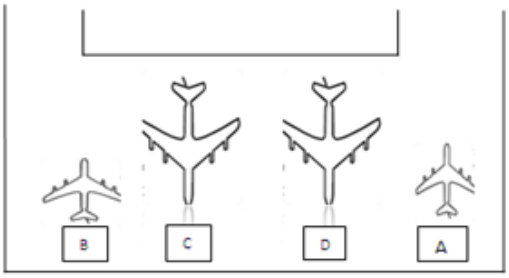

Figure 3. Main Apron parking configuration

In picture 3, it appears that Parking stands A and B are intended for small body type Cesna, Parking stands C and D are intended for Narrow Body type ATR 72-500 series.

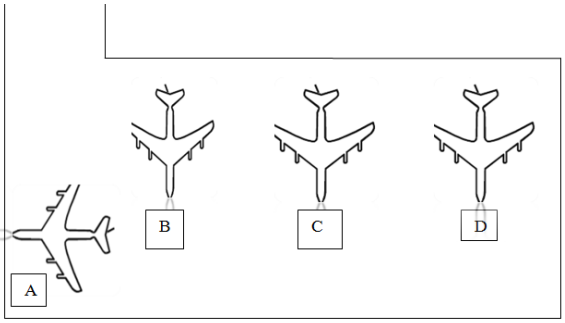

Figure 4. New Apron parking configuration

In picture 4, Parking stand A is for VIP Aircraft, Parking stand B and D are for Narrow body Boing 737 series while for parking stand C is for Narrow Body CJR type.

Parking Index

a. Main Apron parking index

To play the apron, the percentage of planes at parking stand D is more dominant than the percentage of aircraft parked at parking stand C, where Garuda Indonesia aircraft has two flight schedules per day using parking stand D, while for wings only have one flight schedule. in one day by using parking stand C, so that the percentage of planes that park at stand D is more dominant.

The average time to use Apron occurs at 00.00 - 01.00 UTC, 05.00 - 06.00 UTC and 07.00 - 08.00 UTC.

New Apron parking index

For New Apron the percentage of planes parked at parking stands number C and A is more dominant than parking stands number D and B for parking stands D, C and B only available for medium aircraft with a width of 16 meters between parking stands, whereas for parking stands A is reserved for VIP aircraft or chartered aircraft, unscheduled aircraft.

The average time of using Apron occurs at parking stand B at 01.00 - 02.00 UTC, parking stand B and D at 08.00 - 09.00 UTC, and parking stand D at 09.00 - 14.00 UTC.

The accumulation of parking above is domestic aircraft data collection at Banyuwangi Airport, while the use of aprons by training school airplanes routinely flies from 05.00 to 02.00 hrs (used to fly solo in fulfilling mandatory flight hours for pilot study program pilots), while for parking duration is the time span of parking an aircraft somewhere in a unit of time.

Duration of Parking New apron and Main Apron

Table 4. Duration of new apron parking

Flight Number		Type of Air craft	Registration	Landed Time	Parking Stand		Out Parking Stand		Depar ture time	Number of parking stand	Duration (Minute)
Arrival	Departure				Time in apron	Time on bl oc	Time off block	Time clear apron			
NIH252	**NIH253**	**B735**	**PK NAN**	**01:40**	**01:45**	**01:46**	**02:07**	**02:12**	**02:19**	**2**	**21 Minutes**
PK FGT	PK FGT	E15581	PK FGT	08:04	08:09	08:10	-	-	-	4	12 Hours
NH256	**NH257**	**B735**	**PK NAL**	**08:36**	**08:41**	**08:42**	**09:02**	**09:07**	**09:14**	**2**	**20 Minutes**

Source: Calculation results, 2019

Table 5. Duration of Main Apron parking

Flight Number		Type of Aircraft	Registration	Landed Time	Parking Stand		Out Parking Stand		Departure time	Number of parking stand	Duration (minutes)
Arrival	Departure				Time in apron	Time on block	Time off block	Time clear apron			
GIA7302	GIA7303	ATR72	PK GAF	00:00	00:04	00:05	00:25	00:29	00:35	2	20 minutes
GIA7304	GIA7305	ATR72	PKGAF	05:52	05:56	05:57	06:13	06:17	06:23	2	16 minutes
WON1880	WON1881	ATR72	PK WHR	07:24	07:28	07:29	07:47	07:51	07:57	1	18 minutes

Source: Calculation results, 2019

Based on the data in Table 5, it appears that peak hours occur at 06.23 - 08.36 UTC. At that hour the potential of the aircraft to experience a taxiing holding position and a very large delay due to aircraft that come before or have an ETA early who will choose to carry out parking in the nearest area so that blocking other aircraft that will carry out taxi or parking.

There is a significant difference between parking stands with a larger parking accumulation and there are 2 parking stands that have a parking accumulation of 0, so that the parking stand arrangement is not optimal which causes delay or holding. As a result of the prolonged delay, Banyuwangi Airport suffered losses in terms of time and cost of Avtur fuel.

Aircraft that have delayed departure or flight cancellations suffer losses in terms of time that have an impact on airport operations, while planes that experience landing cancellations issue a lot of fuel, especially if the aircraft exceeds the time limit previously calculated for refueling. The variation in fuel prices will be determined by several things such as aircraft size, flight distance, and fuel consumption for each type of aircraft

is different, when a lot of fuel is used by aircraft during operation, the greater the costs incurred by the airlines to refuel. In refueling aircraft, the remainder of the previous fuel is added to the number of aircraft needed to make the next flight.
To calculate operational costs per type of aircraft operating at Banyuwangi airport:

Operating Costs = consumption x Fuel Price

Table 6. Fuel expenditure for aircraft B737-500 and ATR72-500

No.	Airplane Type	Holding Duration (minute)	Fuels Consumption (litre)	Price per liter (IDR)	Spending (IDR)
1.	B737-500	1 minute	50.8	9,490	482,092
2.	B737 -500	2 minutes	101.6	9,490	964,184
3.	B737-500	3 minutes	152.4	9,490	1,446,276
4.	ATR72-500	1 minute	13.1	9,490	124,319
5.	ATR72-500	2 minutes	26.2	9,490	248,638
6.	ATR72-500	3 minutes	39.3	9,490	372,957

Source: Data processing results, 2019

In Table 6, fuel expenditure shows that airport operators are experiencing losses due to increased aircraft operating costs so that traffic services are not optimal

Matters relating to taxi routes and taxiway facilities, namely the taxi's flight time from the apron to the holding point need to be taken into account in allocating runway utilization so as to minimize the buildup of aircraft in the taxiway. Next is the time needed for the aircraft to taxi from the apron to the holding point in seconds like in Table 7.

Table 7. Plane Taxi Time

TAXIWAY					
CAT	**Alpha**	**Bravo**	**Charlie**	**Delta**	**Echo**
Light	±30sec	±30sec	±30sec	±30sec	±60sec
Medium	-	-	±20sec	±20sec	±40sec
Heavy	-	-	±20sec	±20sec	±35sec

Source: Blimbingsari Airport, 2019

The average time needed for a plane to taxi to a holding point is 30-60 seconds, so it must be taken into consideration in allocating runway use time at Banyuwangi Airport.

The runway capacity at Banyuwangi Airport in the percentage of 80% is 16 traffic based on the calculation of the Declared Runway Capacity (DRC) using the Doratask Method with the Formula.

$$DCR = \frac{(UP08\ XTRC08)+(UP26\ XTRC\ 26)}{UP08+\_UP26}$$

DCR = 2032.865 : 100
= 20.329
where :
UP : Percent Utilization Runway
TRC : Theoritical Runway Capacity

From the formula above, the Declared Runway Capacity (DCR) value of 20 movements / hour is obtained. In a 100% percentage capable of accommodating 20 movements to anticipate unexpected traffic (unexpected airplanes, such as emergency, urgency, return to base, and divert) that occur at airports.

The application of the current slot time is based on a joint agreement between the Banyuwangi KCP and the Flight School at Banyuwangi Airport, making it easier for ATC personnel but not yet effective in handling smooth flight traffic at Banyuwangi Airport as shown in Table 8.

Table 8. Slot time for training aircraft

No.	Acft Reg	ETD	EET	Rute
1	PK-RON	0:00	0:50	Circuit
2	PK-ROS	0:05	0:50	Circuit
3	PK-BYD	0:10	0:50	Circuit
4	PK-ROU	0:15	1:00	Training Area
5	PK-BYF	0:20	0:50	Training Area
6	PK-BYK	0:25	1:00	Training Area
7	PK-APA	0:30	1:00	Training Area
8	PK-APB	0:35	1:00	Training Area
9	PK-BYM	0:40	1:00	Training Area
10		0:45	0:50	
11		0:50	1:00	
12		1:55	1:00	
13	PK-RON	1:00	0:50	Circuit
14	PK-BYD	1:05	0:50	Circuit
15	PK-BYC	1:10	1:00	Circuit
16	PK-ROU	1:15	1:00	Training Area
17	PK-ROS	1:20	0:50	Training Area
18	PK-BYF	1:25	0:50	Training Area
19	PK-BYK	1:30	1:00	Training Area
20	PK-APA	1:35	1:00	Training Area
21	PK-APB	1:40	1:00	Training Area

Source: ARO KCP Banyuwangi, 2019

From table 8 it can be seen that the movement of the aircraft is dominated by BP3 Banyuwangi tranning aircraft.

Table 9. Movement of Traffic Date 1-7 November 2017

Time	1	2	3	4	5	6	7
23.00-00.00	7	9	6	0	1	4	11
00.00-01.00	15	17	13	4	1	13	16
01.00-02.00	18	19	15	8	1	16	19
02.00-03.00	9	12	13	7	1	12	16
03.00-04.00	14	13	14	6	0	12	14
04.00-05.00	13	11	8	7	0	14	16
05.00-06.00	16	16	12	6	1	10	12
06.00-07.00	17	16	13	4	2	14	15
07.00-08.00	11	14	7	0	1	14	14
08.00-09.00	10	12	15	1	1	15	14
09.00-10.00	4	5	9	1	1	3	8
10.00-11.00	2	2	1	2	0	2	0
Jumlah	136	146	126	46	10	129	155

Source: KCP Banyuwangi, 2019

Table 9, traffic movement in one hour exceeds the runway capacity, where the application of slot time, Blimbingsari airport has not paid attention to the route taxi, taxi time, runway occupancy and runway capacity have accumulated traffic on the air side and on the land side. Aircraft delay and holding have a high impact on fuel operating costs for the airline. Therefore, the application of slot time or runway usage time needs to be considered so that the smooth movement of aircraft at Banyuwangi Airport can be realized.

Table 10. Slot Time Arrangement

Time	1	2	3	4	5	6	7
23.00-00.00	11	12	6	0	1	10	14
00.00-01.00	15	12	13	4	1	13	14
01.00-02.00	14	14	15	8	1	10	14
02.00-03.00	13	14	13	7	1	12	14
03.00-04.00	14	13	14	6	0	12	14
04.00-05.00	13	13	8	7	0	14	14
05.00-06.00	12	14	12	6	1	10	14
06.00-07.00	13	14	13	4	2	14	15
07.00-08.00	11	14	7	0	1	14	14
08.00-09.00	10	12	15	1	1	15	14
09.00-10.00	8	12	9	1	1	3	13
10.00-11.00	2	2	1	2	0	2	0
Jumlah	136	146	126	46	10	129	155

Source: KCP Banyuwangi, 2019

Based on the movement of traffic in table 10, a significant difference is seen in table 9, so that the smooth movement of planes at Banyuwangi Airport can be created by applying these time slots.

IV. Conclusion

Rearranging time slot in Banyuwangi airport for domestic aircraft and training aircraft are to optimize the use of aprons. Alternative solutions can be done by expanding the apron, combining the Main Apron with the New Apron in serving domestic flights and combining the apron alpha with bravo in serving training aircraft, and restructuring the parking stands of all types of aircraft operating at Banyuwangi airport.

Acknowledgment

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