IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE)
e-ISSN: 2278-1684,p-ISSN: 2320-334X, Volume 15, Issue 4 Ver. III (Jul. - Aug. 2018), PP 26-30
www.iosrjournals.org

The Operational Utilities Of The Syukuran Aminuddin Amir Airport In Luwuk, Banggai Regency of Central Sulawesi

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Abstract: *The demand for air transport movement, air transport traffic and passengers at Syukuran Aminuddin Amir Luwuk Airport increased from the growth and development of airport facilities, so that the operational performance decreased. To anticipate this, it will be necessary to increase facilities strategy, according to the dynamics of transportation demand in the future. This study aims to analyze how the performance of the availability of infrastructure and airport facilities using quantitative and Norms, Standards, Procedures and Criteria (**NSPC)** analysis. Found that runway and existing terminal conditions are not able to serve the movement of aircraft and passengers for the next 15 years.*

Keywords: *Transportation demand, Aircraft Movement, Runway and terminal.*

Date of Submission: 12-07-2018 Date of acceptance: 26-07-2018

I. Introduction

The airport is the node of the air transport network, where inter modes displacement and transportation inter modes are taking place. In its operations there are various interactions between steak holder such as the airport, the airline operator, and the users of land and air transportation services.

Syukuran Aminudin Amir Airport is located in Bubung Village, Southern Luwuk District, Banggai Regency, Central Sulawesi, positioned parallel to the southernmost coastline, and is at the foot of the hill with a height of 17 m above sea level. The status of the previous airport is the Perintis Bubung field which is developed into a class II airport

Syukuran Aminudin Amir Luwuk Airport is equipped with complementary buildings; Runway length 2250x30 m with one way configuration; Taxiway size 60x15 m; Apron size 200x60 m with a capacity of 2 aircraft type F-100; Runway Shoulder (1.910x15 m); Runway Strip (1.970x150 m); stops way (60x30 m). The type of aircraft that operates the F-100 capacity of 115 passengers, and B-737-200 with a capacity of 120 passengers, with Palu-Manado-Makassar-Surabaya-Jakarta flight route.

On the other hand, every year the number of passengers arriving and departing has increased, requiring larger airplane passenger service facilities and also requiring a longer runway size. To anticipate this need to increase the facilities adequate for the projection of the next few years in anticipation of increased demand growth in the future.

II. Materials And Method

This study uses secondary data on the movement of aircraft and passengers within the time frame of 2011 to 2015, mainly related to secondary information of monthly data fluctuations of aircraft movement and daily fluctuations. Using qualitative and quantitative methods, regression analysis is used to predict the growth of aircraft and passenger movements, as well as a compilation with Norms, Standards, Guidelines and Manual (NSGM-Planning) on the formula of facilities and facilities development of the Airport (PM No. 69 Year 2013).

III. Results And Discussion

Aircraft Movement

The growth of aircraft movements for the last five years fluctuated by the year of flight service, in 2011 the movement of aircraft arrived and departed as many as 2,096 movements arrived and departed, by 2015 the movement of the aircraft as much as 4,279 movements. The growth rate is between 10.9% to 48.37%, or an average of 19.53% per year, the highest growth occurring in the 2013-2014 period. Based on the results of regression analysis, forecasting the movement of arrival and departure of aircraft at Syukuran Aminuddin Amir Airport in Luwuk show as follows:

Liner : $Y = 553.8\ X + 1239$, $r^2 = 0.843$……..……	(1)
Exponential : $Y = 1607.e^{0.183X}$, $r^2 = 0.858$……..……	(2)
Polynomial : $Y = 168.1X^2 – 455.0X + 2416$, $r^2 = 0.952$…..……	(3)
Logarithmic : $Y = 1232.Ln\ (X) + 1720$, $r^2 = 0.674$, ……..……..	(4)

The value of the regression coefficient indicates that the equation (3) Polynomial regression has the greatest R (reliability/percent survives) value of 95.2% and the number of aircraft movements for the 5th year of 4,343 approximates the historical data of 4,279 in 2015. The following equation Polynomial regression of the movement of planes coming and departing as follows:

$Y = 56.92X^2 – 128.6X + 1128$, $r^2 = 0{,}944$
$Y = 57x^2 – 129X + 1128$, $r^2 = 0{,}944$

Based on the regression equation obtained the total movement of aircraft for the plan year in 2032 is about 51,730 movements.

Passenger Movement

Analysis of the movement of aircraft, projected forecasting the movement of passengers at Amiruddin Amir Airport in Luwuk by using regression analysis based on data from 2011 to 2015 obtained by the regression equation as follows:

Linear	: $Y = 29268\ X + 81244$,	$r^2 = 0.960$
Exponential	: $Y = 96409.e^{0.176X}$,	$r^2 = \mathbf{0.961}$
Polynomial	: $Y = 2461.X^2 – 14501X + 98471$,	$r^2 = 0{,}959$
Logarithmic	: $Y = 69859.Ln\ (X) + 10215$,	$r^2 = 0.883$

Based on the analysis of the exponential regression equation that has the highest R (reliability/percent survey) value of 96.1% and the number of passenger movements for the year 2015 of 232,432 passengers, almost close to the historical data of 234.669 passengers.

The following exponential regression equations obtained from the movement of planes coming and departing as follows.

Arrival	$Y = 46506e^{0,181X}$	$r^2 = 0{,}942$
Departure	$Y = 47494e^{0,180X}$	$r^2 = 0{,}972$

The predicted total number of passenger movements for the year of 2032 is 4,985,254 passengers.

Peak Month, Peak Day, and Peak Hour

The total number of aircraft movements in the runway in the year of the plan, calculated by the peak hour volume, is the number of aircraft movements under peak hour conditions. To obtain the peak month ratio is based on historical data on airplane movement each month in 2011 until 2015 as in **Figure 1.**

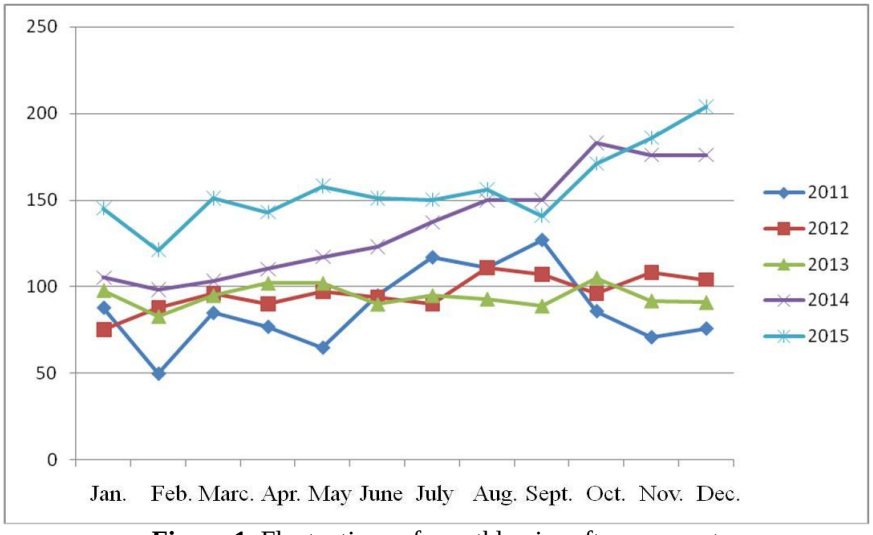

Figure 1. Fluctuations of monthly aircraft movement

The ratio is calculated by the following formula:

$R_{month} = N_{month} / N_{year} = 88 / 1048 = 0{,}083$

The highest ratio of aircraft movement occurred in September 2011 amounted to 0.121.In order to get the maximum projection of aircraft movement during the peak year of the plan, it can be used Peak Month the largest ratio is 0.121.

Table 1. Index Ratio of aircraft monthly movement

No.	Month	Total Movement				
		2011	2012	2013	2014	2015
1	January	0.083	0.065	0.086	0.064	0.077
2	February	0.048	0.076	0.073	0.060	0.064
3	March	0.081	0.083	0.084	0.063	0.080
4	April	0.073	0.078	0.090	0.068	0.076
5	May	0.062	0.084	**0.096**	0.072	0.084
6	June	0.091	0.081	0.079	0.076	0.080
7	July	0.111	0.078	0.084	0.084	0.080
8	August	0.106	**0.096**	0.082	0.092	0.083
9	September	**0.121**	0.093	0.078	0.092	0.075
10	October	0.008	0.083	0.093	**0.112**	0.091
11	November	0.068	0.093	0.081	0.108	0.099
12	December	0.073	0.090	0.080	0.108	**0.109**
Total		1.000	1.000	1.000	1.000	1.000

Source: Analysis Results, 2016

To get the Peak day ratio required data on the number of aircraft movements per day. The data can be seen on the data of aircraft movement in September of 2011, where the number of movements taken is the largest on the same day dated as different as in Table 2.

Table 2. Number of daily movements in September 2011

Day	**Date**	**Total Movement**	**Total**	**% Movement**
Monday	5,12,19,26	14	56	**0,046**
Tuesday	6,13,20,27	8	32	0,026
Wednesday	7,14,21,28	12	48	0,039
Thursday	1,8,15,22,29	8	40	0,026
Friday	2,9,16,23,30	12	60	0,039
Saturday	3,10,17,24	8	32	0,026
Monday	4,11,18,25	9	36	0,030
	Total		304	

Source: Syukuran Aminuddin Amir Airport Office

The calculation of the peak day ratio is done as follows based on data in September 2011, the number of aircraft movement is as much as 304 movements, the movement of aircraft on Monday is as many as 56 movements. Monday's ratio is the number of aircraft movements on Monday divided by the number of aircraft movements in September.

$R\ day = N\ day / N\ month = 14 / 304 = 0{,}046$

Monday is the busiest day of the week, so the movement's ratio on Monday of 0.046 is the peak day ratio. From the existing data on the number of aircraft per hour and the daily number of aircraft movements on the busiest day, we can know the peak hour ratio.

To get the Peak hour ratio is the total number of movements in peak hour divided by the total number of 1 day movement. The ratio is calculated from the formula:

$R_{hour} = N_{hour} / N_{da} = 3/14 =$ **0,214**

Known Total moves On Monday, September 26, 2011 14 movements. The busiest hour is 12.00 pm - 12.59 pm with 3 airplane movements.

By knowing the peak month ratio, peak day ratio and peak hour ratio of existing conditions, the number of aircraft movements in the peak hour condition of the 2032 plan year can be calculated.

Table 3. Performance of Airport Infrastructure

Year	Movement of the aircraft			
	Per year	Peak Month	Peak Day	Peak Hour
2018	7.486	906	42	9
2022	15.569	1.884	87	19
2027	30.799	3.727	171	37
2032	51.726	6.259	288	62

Source: Analysis Results, 2016

From the table 3 above in 2022 the number of aircraft movements in the runway during peak hours is 19 movements/hour. And according to the calculation of development facilities PM No. 69 Year 2013:

$$IAP4_{\text{The air side}} = \frac{\text{Annual Airplane Movement}}{\text{Annual Airplane Movement Capacity}} = \frac{19}{30} = 0.63,$$

Means that the available capacity is still sufficient, no need to be developed. Because IAP4 requirement is less than 0.75. While in 2027 the number of aircraft movements in the runway during peak hours is 37 movements/hour. And according to the calculation of development facilities PM No. 69 Year 2013 is 1.23 means Available capacity can be developed because the IAP4 requirement must be more than 0.9. And in 2032 the number of aircraft movements in the runway during rush hour is 62 movements/hour. And according to PM No. 69 Year 2013 is 2.07 means that the available capacity can be developed.

Table 4. Performance of Airport Facilities

Year	Passenger Movement		
	Yearly	Daily	Peak Hour
2018	398.322	1.091	131
2022	**819.955**	**2.246**	**270**
2027	**2.021.796**	**5.539**	**665**
2032	**4.985.254**	**13.658**	**1.639**

Source: Analysis Results, 2018

From the table 4 above obtained the number of passengers during rush hour of 2022 as many as 270 passengers. And according to the calculation of development facilities PM No. 69 of 2013

$$IAP4_{Land\ Side} = \frac{\text{Passenger Busy Time x Standard Area Terminal}}{\text{Wide Existing Terminal}} = \frac{270\ x\ 14}{4250} = 0{,}89;$$ meaning that the available capacity can be developed, because the standard passenger terminal according to IAP4 > 0.75

While in the year 2027 obtained the number of passengers during rush hour as many as 665 passengers. And according to the calculation of development facilities,

$$IAP4_{\text{Land Side}} = \frac{665\ x\ 16}{4250} = 2{,}50$$

And in the year 2032 obtained the number of passengers during rush hour as much as 1639 passengers and according to the calculation of development facilities

$$IAP4_{\text{Land Side}} = \frac{1639\ x\ 16}{4250} = 6{,}17$$

Thus the standard terminal area in 2027 and 2032 according to IAP4 > 0.75 means that the available capacity can be developed.

IV. Conclusion

The availability performance of Aminuddin Amir Luwuk Airport Measurement Facility and Infrastructure is limited Runway capacity, need to be developed to anticipate predicted future demand growth until 2032. Unable to serve airplane movement in the year of 2032. Where according to the calculation of development of IAP4, the existing capacity more than 0.9 means the need for airport development. The extent of the existing terminal is not capable of serving passenger movement during the year of 2032. As the IAP4 standard is more than 0.75 it means that the terminal area should be developed

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Dinar Mardiana "The Operational Utilities Of The Syukuran Aminuddin Amir Air Port In Luwuk Regency, Central Sulawesi." IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) , vol. 15, no. 4, 2018, pp. 26-30