International Journal of Innovative Technology and Exploring Engineering (IJITEE)
ISSN: 2278-3075, Volume-8, Issue-4S February, 2019

Air Side Development at OesmanSadik Airport, South Halmahera District

Rasburhany U, SaktiAdji Adisasmita, Tri Harianto

Abstract: OesmanSadik Airport, South Halmahera District requires an air transportation that can serve passengers, by overcoming the limitations of transport capacity, the length of the runway and the limited flight routes that operate today. Through the air side analysis of OesmanSadik Airport and the use of alternative aircraft, it is expected to give a little consideration for the development plan of OesmanSadik Airport in an effort to anticipate future developments. This is to ensure that it can serve the needs of safe airport services, comfortable, economical, and can meet the needs of the community. This study evaluate the runway dimension, which is in accordance with the planned aircraft's needs which is for short and long-term service with the largest aircraft ATR-72 Series 500 and for long-term service with Boeing 737 Series 500 aircraft using the ICAO (International Civil Aviation Organization) method. From the results of this analysis, 3 aircraft types ATR-42, Cassa 212 and Dornier 328 with flight schedules 6 times a week are not expected to be able to serve the number of passengers in 2027. The alternative solutions is to use 1 aircraft of the ATR-72 Series 500 that can overcome the need for short-term passenger carrying capacity and the length of the existing runway is still able to serve flight requests. However for long-term services, Boeing 737 Series 500 aircraft is used which require additional runway lengths of 1,400 to 2,656 m.

Keywords: OesmanSadik Airport, runway length, aviation, ICAO method

I. INTRODUCTION

The existence of OesmanSadikLabuha Airport as a transportation infrastructure in South Halmahera Regency, North Maluku Province, has contributed significantly to regional and national economic development, especially in providing mobility for economic actors and the people of South Halmahera Regency and surrounding areas. Suyono (2017) and Setiawan et al. (2018) in their studies justified that. airport performances do impact the country's Gross Domestic Product (GDP) [1-2].Especially with the increasingly strong implementation of regional autonomy, the existence of air transportation facilities and infrastructure is expected to encourage the acceleration of economic growth in the region The development of an airport is a complex and integrated with various fields of work, disciplines and skill levels that are truly qualified due to its association with guidelines, standards and technical rules that are applied internationally and are closely related to intra integration and between modes of transportation within the area to be served.

Revised Manuscript Received on February 05, 2019.

Rasburhany U, Civil Engineering Department, Hasanuddin University, Jl. PerintisKemerdekaan Km. 10, Tamalanrea Indah, Tamalanrea, Kota Makassar, Sulawesi Selatan, 90245, Indonesia.

SaktiAdji Adisasmita, Civil Engineering Department, Hasanuddin University, Jl. PerintisKemerdekaan Km. 10, Tamalanrea Indah, Tamalanrea, Kota Makassar, Sulawesi Selatan, 90245, Indonesia.

Tri Harianto, Civil Engineering Department, Hasanuddin University, Jl. PerintisKemerdekaan Km. 10, Tamalanrea Indah, Tamalanrea, Kota Makassar, Sulawesi Selatan, 90245, Indonesia

Therefore, in the development of an airport, an approach and methodology is needed by considering various aspects including regional, technical, economic, aviation operations, environmental and defense and security development strategies so that the investment can be efficient and effective given the airport development is a capital-intensive and high-technology work. A computer program which will provide information on runway location, orientation, and length design is developed by Sarsam and Ateia (2011) is believed to be beneficial in designing an airport in Iraq [3].Givoni and Rietveld (2009) stated that as distance between the two endpoints increases, aircraft size increases and frequency decreases [4]. Runway length also positively affects flight frequency, though its effect may be more indirect because airports with long runways also tend to have more runways, and are thus capable of having more aircraft movements [5]. The increase in the airport capacity has led to the future plans of expanding the exisitingOesmanSadik Airport. Thus, this study is intended to analyze the needs of the length of the runway at an airport OesmanSadik with the current traffic conditions and development needs of airside facility for the next 15 years at the airport.

II. METHODOLOGY

This type of research was carried out using descriptive quantitative method by examining the performance of OesmanSadik Airport runway service on aircraft traffic movements in the form of Take Off and Landing processes using the ICAO method. The sample in this study is the number of aircraft traffic movements at the airport. The data collection was carried out by measuring the level of aircraft movement time union with a measure that was assessed is the number of aircraft taken off and landing on the runway of OesmanSadikBacan Airport and the type of aircraft that operates with the benchmark being assessed is the passenger and baggage carrying capacity of the aircraft type operating at the airport. In addition there are other supporting data such as population data obtained from the Central Statistics Agency (BPS) of South Halmahera Regency, data on rainfall, wind speed and air humidity obtained from the Meteorology, Kilimetology and Geophysics Agency (BMKG) OesmanSadik Airport Station South Halmahera Regency, plan aircraft data, airport elevation data and runway slope data. The data obtained from this study are then processed using the ICAO method to obtain the runway dimensions in the form of length and width of the runway needed based on the plan aircraft which will be operated on short-term and long-term development plans and forecast passenger traffic and aircraft movement in the next 15 years using the Forescasting method to determine the type of aircraft planned to be operated based on the number of passengers in the projected year.

Published By:
Blue Eyes Intelligence Engineering
& Sciences Publication

III. RESULTS and DISCUSSION

Runway Length Analysis

Phase I, planned with ATR-72 (500 series) aircraft

With reference to Table 1, the calculation of the correction of the runway length for take-off based on the ATR-72 (500 series) aircraft specification data, the runway length required for takeoff according to the ISA in the sea level is 1290 m. Then, the approximate length of this runway is corrected to the height (elevation), temperature; runway slope obtained by the length of the runway for take-off is 1371 m.

Table. 1 The type and characteristics of the flight

Aircraft characteristics	Unit	**ATR 72 Seri 500 (Machine: Pratt & Whitney Canada PW 127 F/M)**	**Boeing 737 Seri 500 (Machine: CFM Intl. CFM56 3B1)**
Passenger capacity	org	68 – 74	132
Long	m	27,16	31,01
Wingspin	m	27,05	28,88
Height	m	7,65	11,07
Empty weight	kg	12,950	31.300
Maximum Take Off Weight (MTOW)	kg	22,500 (basic), 22,800 (option)	60.550
The length of the runway as MTOW	m	1.290	2.499
Max speed	km/hour	640	946
Take Off Field Length	m	1.220	1.804
Landing Field Length	m	1.050	1.340

Phase II, planned with Boeing 737 (500 series) aircraft

Since the planes are B 737 Series 500, and referring to the MTOW maximum of 60,550 kg, the ARFL value is 2499 m. Then the approximate length of this runway is corrected to the height (elevation), temperature, runway slope obtained by the length of the runway for take is 2565 m as listed in Table 2. Given the condition of the existing airport has a runway length of 1400 m, then if the aircraft B 737 Series 500 is considered, the runway length was 2656 m. Therefore, for the next 15 years the length of the runway needs to be increased by 2656 - 1400 = 1256 m. The following results of the overall analysis are listed in Table 3.

Table. 2 Results of the analysis of corrections Fe, Ft, Fs, surface winds and ARFL

Amendments to the elevation factor (m)	Amendments to the temperature factor (m)	Amendments to the Slope factor (m)	Amendments to the surface of the wind factor	ARFL (m)
1,004	1,058	1,0005	-5/+7	2.656

Table. 3 Aeroplane Reference Field Length (ARFL) in SadikOesman Airport

Runway	**Development**	**Existing length**	**ARFL**
Existing		1400 m	1317 m
Phase 1	The length of runway required for ATR-72 Series 500	1290 m	1371 m
Phase 2	The length of runway required for a Boeing 737 Series 500	2499m	2656m

Width running analysis

Based on the ARC (Aerodrome Reference Code) code issued by ICAO for ARFL 1200 - 1800 m, code number 3 and code letter C for the aircraft of the largest plan, the type ATR 72 Series 500 with wingspan criteria (27.05 m) and

Published By:
Blue Eyes Intelligence Engineering
& Sciences Publication

Outer Main Gear Wheel Span (4.1 m), runway width is obtained for the development plan of the optimization stage of 30 m (100 ft) with the shoulder runway, the total runway and shoulder width of the base is at least 45 m (150 ft). As for the largest aircraft plan type Boeing 737 500 Series with wingspan criteria (28.88 m) and Outer Main Gear Wheel Span (5.23 m). Based on the code of ARC (Aerodrome Reference Code) issued by ICAO for ARFL> 1800 m, numeric code and letter code, namely 4C with the planes, the width of the runway was obtained for the long-term development of the ultimate stage of 45 m (150 ft) with the shoulder pad , the total width of the runway and shoulder base is at least 60 m (200 ft) for codes D and E with the shoulder width of the runway = 7.5 m on both sides of the runway.

Forecasting passenger movement

The movement of the number of passengers, population and (Gross Regional Regional Income) GRDP in the analysis of OesmanSadikBacan Airport development refers to the growth method of the Linear Trend. The projection of passenger volume growth for 2013 - 2027 is assumed to increase every year with passenger growth of 20%. The factor of community trip generation to use air transportation mode is assumed by the approach to people's purchasing power with GDP and per capita GRDP indicators, while the potential number of passengers is closer to the population indicator.

Forecasting aircraft movement

Projection of aircraft movements used to plan the construction of OesmanSadikBacan Airport, namely the data of aircraft movements at the airport from 2008 to 2012 with a growth factor of 20%. Prediction of aircraft volume movement in 2013 – 2027 is made by using aircraft movement data from 2008 - 2012 at OesmanSadikBacan Airport, obtained the peak hour volume plan of aircraft movements at OesmanSadikBacan Airport, such as shown in Table 4 and Table 5.

Table. 4 Aircraft and passenger movement every 5 years

Year	Passenger movement			Aircraft movement		
	Arrival	Departure	Total	Arrival	Departure	Total
2017	6.969	7.364	14.333	475	475	950
2022	12.064	12.493	24.557	758	758	1.516
2027	17.159	17.621	34.780	1.040	1.040	2.080

Table 5. Prediction aircraft movement at the airport OesmanSadik every 5 years

Prediction year	Peak hour volume (pswt)
2017	2
2022	2
2027	2

Previous studies have been conducted that examine the runway and airport taxiways with forecasting. Some researchers who have discussed the development of the air side of an airport also argue that basically the development of the air side of an airport is very dependent on forecasting and demand, such as in the research conducted by Permana and Hidyastuti (2013), which analyzed the needs of runway and taxiway requirements for operational plan aircraft to be used in the next 15 years using the ICAO method[6]. With the ARFL correction of the existing runway conditions, the current runway length is less than the runway length of 2819 meters. For the next 15 years, traffic flow forecasting is carried out with linear regression analysis from 2012 to 2026.

From the results of the forecasting, the total aircraft movements were 13 610 movements and the total passenger movements were 3 017 908 passengers with a peak volume of 202 passengers per service. Thus, it was planned to use B 737 900 ER aircraft because this aircraft has a passenger capacity of 213 seats. This aircraft is the reference for planning the runway dimension.

Wicaksono, Kurniadi and Rahmawati (2012), evaluated the air side facilities of Blimbingsari Airport in Banyuwangi Regency which includes runway, taxiway, apron and pavement in the framework of the development stage in order to meet the needs of aviation services in the coming year. In this study, the
planes studied were Boeing 737-500 for domestic flights[7]. The duration of the plan is 20 years. Passenger forecasting is done by linear regression method. From forecasting analysis and technical planning of Blimbingsari Airport air side facilities in Banyuwangi Regency, it can be concluded that the prediction results of forecasting the number of passengers at Blimbingsari Airport Banyuwangi in 2028 are 363 492 30 people coming in and 411 267 39 people leaving. For the year 2028, the predicted frequency of the aircraft used for BlimbingsariBanyuwangi Airport with Boeing 737-500 which has passenger capacity of 135 people were, arrival of 7 aircraft per day and departures of up to 8 aircraft per day. The results of the technical planning of Blimbingsari Airport's air side facilities in Banyuwangi Regency are in comparison with the existing conditions. From the results of the analysis it was found that the length of the runway plan is 3000 m, longer than the existing runway (2250 m). The runway width requirement is 30 m, the same as the existing runway width (30 m). Taxiway plans with a width of 30 m, longer than the existing taxiway (23 m). The number of taxiway planned is 2, which is more than the existing taxiway (1 piece). Existing apron of 180 x 80 m, while the calculation results obtained 220 x100 m. the current pavement thickness is 78 cm (critical area), 57 cm (non-critical area), and 38 cm (transition area).

The thickness of the pavement obtained based on the calculation results is in the critical area of Phase I (37 cm) and Phase II (38.4 cm), the non-critical area of the calculation obtained is smaller than the existing condition.

*Published By:
Blue Eyes Intelligence Engineering
& Sciences Publication*

Dondokambey, Rumajar, Manoppo, and Waani (2013) conducted a study on Balikpapan Sepinggan Airport development planning by analyzing five-year data on the number of planes, passengers, baggage and cargo using regression analysis, which is able to predict future traffic flow so that airport development can be known[8]. Based on the results of calculations that refer to the International Civil Aviation Organization (ICAO) standard with Boeing 747-400 planes, it will require a runway of 3 949 meters and a runway width of 60 m. The distance between the axis of the runway and the axis of the runway is 185 m. The total taxiway width is 38 m, and the required apron area is 123 082 m^2.

Hazanawati and Sartono (2009) conducted a study on the development of the air side of Japura Airport in Indragiri Hulu Regency with the aim of realizing an ideal airport with facilities in accordance with the requirements so that airport services can be achieved quickly, safely, comfortably, effectively, efficiently and optimal for the safety of flight operations, passengers and other airport service users. The conclusion obtained from this study is that Indragiri Hulu Regency has a GDP that increases every year with a 10% increase each year, while the population also increases yearly by 5%. Based on the analysis, the growth of the number of passengers each year for the next 20 years has increased by 6% and the increase in the number of aircraft for the next 20 years by 15%[9]. This is very encouraging because it can trigger the management to operate the airport optimally as possible with the results of the prediction. In phase I or the optimization stage, the existing Japura Airport in Indragiri Hulu Regency has not undergone a fundamental change, except for repairs and maintenance if they are re-functioned. In stage II or the ultimate stage with the runway length needed to service aircraft type B737 - 400 of 2179 m (already corrected), the existing length of runway needed to be extended by 879 m. For the width of the runway with various regulations from the ICAO and FAA, a value of 30 m is obtained, while the width of the existing runway is 30 m. For taxiway dimension analysis using ICAO and FAA methods based on B 737 - 400 planes, then the taxiway width is 15.0 m while the existing taxiway width is 23.0 m, meaning that the existing airport can still serve aircraft types B 737 - 400 for the next 20 years. For the existing apron dimensions before the presence of aircraft type B 737-400, has a length of 80 m and a width of 60 m. However after being analyzed using an aircraft the plan for the next 20 years, the obtained apron dimensions length was 93 m, apron width was 63 m. This is expected to serve the needs of the aircraft in the ultimate stage later.

IV. CONCLUSION

From the results of this study it can be concluded that from the existing conditions with ARFL correction of the 500 Series ATR-72 planes as the longest aircraft planned to operate at OesmanSadikBacan Airport on stage I development, the minimum runway length should be 1 371 m. While the runway length is only 1400 m, so the runway length still meets the minimum length standard based on ARFL correction.

In the 15 year plan, namely in 2027, the total forecasting results of aircraft movements are 1040 movements and the total passenger movement is 17621 people. From the calculation of peak hour plans on total movements in 2027, the flight departure volume at peak hours was 3 aircraft and passenger departure volumes were 141 people at peak hours. Then the number of passengers obtained for a single departure at the peak volume, which is 47 people, so the recommended type of aircraft planned for the development of phase I, is aircraft type ATR-72 Series 500 with a passenger capacity of 68 seats.

Based on the geometric analysis of the foundation for the phase II long-term development plan, for the aircraft type B 737 Series 500, it was found that the runway length and width were 2656 m and 45 m with a shoulder pad.

ACKNOWLEDGEMENT

The author would like to acknowledge and thanks to (BPS) of South Halmahera Regency, (BMKG) OesmanSadik Airport

Station South Halmahera Regency for information support as well as Civil Engineering Department, University of Hasanuddin for unconditional support.

REFERENCES

1. J. Suyono, A. Sukoco, M.I. Setiawan, Suhermin, and R. Rahim, Journal of Physics: Conference Series 930, 012045 (2017).
2. M. Setiawan, S. Surjokusumo, D. Ma'Soem, J. Johan, C. Hasyim, N. Kurniasih, A. Sukoco, I. Dhaniarti, J. Suyono, I. Sudapet, R. Nasihien, S. Mudjanarko, A. Wulandari, A.S. Ahmar, and M. Wajdi, Journal of Physics: Conference Series 954, 012024 (2018).
3. S.I. Sarsam and H.A. Ateia, Transportation and Development Institute Congress 2011 (2011).
4. Givoni, M. and Rietveld, P., Transportation Research Part A: Policy and Practice, 43,5 (2009)
5. V. Pai, Journal of Air Transport Management 16, 169 (2010)
6. Permana, S. J., &Hidyastuti, H. (2013). Permana, S. J., &Hidyastuti, H 42, 203 (2013).
7. Wicaksono, A., Kurniadi, A., &Rahmawati, I. 29-36. 42, 101 (2012).
8. Dondokambey, F. G., Rumajar, A. L., Manoppo, M. R., &Waani, J. E. JurnalSipilStatik, 1,4, (2013).
9. Hazanawati, H., &Sartono, W. (2009).