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ANALYSIS OF NOISE IMPACT FROM SULTAN SYARIF QASIM II PEKANBARU INTERNATIONAL AIRPORT ACTIVITIES

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Abstract

The more developed a province area, the more developed means of transportation in the city. Especially airplanes. This transportation is increasingly needed; various types of aircraft connect airports throughout the International. The purpose of the study was to determine the impact caused by the Noise of Sultan Syarif Kasim II Airport activities on the community around the airport area, then compare the noise level in settlements and airports with the Ministry of Environment Decree No. 48 of 1996 of the noise level quality standard. By using a Sound Level Meter (SLM). The research was conducted for three days, the first day was conducted in the southern residential area, the second day was conducted in the northern residential area, and the third day the research was conducted in the airport area. The results showed that the northern housing 73.43 dBA and the southern housing 75.69 dBA exceeded the noise level quality standard set at 55 dBA. The highest exposure duration was at the northern runway location, and the eastern runway noise exposure was only allowed for 3 hours. The Time Weight Average (TWA) or average daily Noise on the runway is 89.1 dBA, exceeding the standard that has been set, which is 85dBA, Kepmenaker No.51/1999), the maximum that workers can receive in one day of 8 working hours can only receive 85 dBA. Based on the research analysis results, it was found that Noise has disturbed the comfort of residents. It is better if the airport's location must have land use moved to a new location far from residents' settlements.

Keywords: Airport Activity, Noise, Noise Impact

INTRODUCTION

Along with the high needs of the people of Provinces Riau for air transportation, it certainly influences flight activities in Riau. The higher the flight intensity and the increase in the number of passengers. Currently, Sultan Syarif Kasim II International Airport stands on an area of about 321 hectares, has a runway that has been extended from 2,600 meters to 3,000 meters. With airport operations for 24 hours. The increase in the number of planes landing and taking off at Sultan Syarif Kasim II Airport has also caused an increase in noise levels around the airport.

Parakesit D (1997) Airport is a gateway to connect economic centers, tourist areas, and government centers. To connect these places used means of transportation such as airplanes.

The intensity of airport noise is determined in addition to the number of aircraft operating (cumulatively for 24 hours) with all their activities, including the time of landing, take-off, movement to the runway, and engine testing, as well as the type of engine used by the aircraft.

Sultan Syarif Kasim International Airport is also the home base for the 12th air squadron and 16th air squadron, which has the task of securing and maintaining the sovereignty of the airspace of western Indonesia.

The activity of airplanes, both commercial and military aircraft belonging to the Indonesian Air Force, causes noise problems that need to be taken seriously considering the population growth of Pekanbaru. The number of residents in Pekanbaru is growing in 2018 by 1,064,000 people (Statistics Agency, 2018).

Malkamah Siti (1997) Noise is unwanted sound from a business or activity at a certain level and time that can cause disturbances to human health and environmental comfort. Hutapea (2000), Noise at airports comes from aircraft that are being operated or under maintenance. The amount of noise depends on the type of machine used. The amount of Noise that reaches the object depends on the distance between the noise source, the weather conditions in the area affected by the Noise, and the obstacles that hinder the Noise from settlements, offices, etc. In addition, noise exposure will be very different during the day compared to night.

(Kep. Men LH. N0. 48 of 1996), or all unwanted sounds originating from production process tools and or work tools at a certain level can cause hearing loss (Kep. Men Naker. No. 51 Years). 1999). Sasongko (2000) Noise is an unwanted by-product of an airport environment caused by airport operational activities, namely the sound of aircraft engines causing Noise that affects an activity.

Noise generated by aircraft when operating in the vicinity of airports can cause social, ecological, technical, and economic problems (Fisher and Morfey 1982). Aircraft noise around airports was an issue some 40 years ago when passenger jet aircraft first served with airlines (Lyle 1990). The general public began to complain and these complaints began to increase. In 1966, one of the first international conferences, the London Noise Conference, was held to discuss the development of the problem of aircraft noise (South Africa Department of Transport 1999). In 1971, the International Civil Aviation Organization (lCAO) adopted noise limit rules as the basis for commercial aircraft certification, and since then, aircraft noise in developing areas has been regulated (ICAO 1993). Major airports have taken initiatives and created noise control offices, regularly producing reports on aircraft operations and planned developments (Airservices Australia 1996).

Opposition to aircraft noise has grown stronger since jet aircraft operations began (Horonjeff 1983). Potter (1970) raised concerns about the chronic and growing problems caused by aircraft operations at large airports. In addition, according to Horenjeff (1983), a severe problem faced by aviation is aircraft noise. Reaction to aircraft noise depends on the individual's experience of unwanted Noise (Kryter 1985). Noise does not always produce a visible effect, and there is usually no distinction in the cause-and-effect relationship between a noise event and an adverse health effect. Some people believe that Noise does not cause severe effects on human health (Rosano 1991). However, evidence from several studies, especially on students in schools, yields strong evidence that Noise can harm human health and reduce children's quality of life and learning abilities (Evans 1995).

METHOD AND PROCEDURES

The sound pressure level value is the weight of a continuously stable sound in a specific time interval *T*, equal to the average square of the sound pressure that varies in pressure level during that

time. $L_{Aeq,T}$ is the *A*-weight equivalent continuous sound pressure level defined in the time interval *T*, starting with t_1 to t_2. This is given by the formula below :

$$L_{Aeq,T} = 10 \log_{10}\left(\frac{1}{t_2 - t_1}\int_{t_1}^{t_2}\frac{p^2A\,(t)}{p^20}\,dt\right)$$

Where :
P_0 : Reference sound pressure (20 µPa)
P_A : A-weight instantaneous sound pressure of a sound signal

Statistical distribution analysis can be used for widespread use, significantly if the Noise fluctuates with different sampling times. So the calculation of $L_{Aeq,T}$ can be done by measuring the instantaneous sound pressure level L_{Pai} with sampling time in the time interval t_2 - t_1. Then the above formulation can be written as the following formula 3:

$$\mathrm{L_{eq}} = 1olog\frac{1}{T}\int_0^T\left(\frac{p(t)}{p0}\right)^2 dt$$

$$L_{Aeq,T} = 10 \log_{10}\left(\frac{1}{N}\sum_{i=1}^{N} 10^{LPai/10}\right)$$

Where :
N : Total number of measurement samples $\left(N = \frac{t_2 - t_1}{\Delta t}\right)$
L_{Pai} : Value of instantaneous sample sound pressure level in decibel-A
Δt : measurement sampling time interval

If the Noise does not fluctuate but appears with a value that is easily distinguished by the sound pressure level, then the equivalent continuous sound pressure level can be calculated using the formula :

$$L_{Aeq,T} = 10 \log_{10}\left(\frac{1}{T}\sum_{i=1}^{N} T_i \,.\, 10^{L_{Pai}/10}\right)\ dB$$

Where :
T : Total time interval
L_{Pai} : A-weight equivalent continuous sound pressure level in time interval

Calculation of 1 minute L_{eq} data, calculated using the formula :

$$leq(1\ menit) = 10 \log\frac{1}{60}\left[\left(10^{0.1\,L_1} + 10^{0.1\,L_2} + \cdots + 10^{0.1\,L_{12}}\right)5\right]\ dB(A)$$

This formula is used every minute until L_{eq} data is obtained 1 minute to 10 minutes readings are carried out every 5 seconds. After each 1-minute L_{eq} value is obtained, then proceed with the 10 minutes L_{eq} calculation representing a certain time interval, so that 120 data is obtained, then calculated using the formula :

$$L_{Aeq,T}(10\ \text{menit}) = 10 \log_{10}\sum_{i=1}^{120} 10^{L_{Pai}/10}$$

Where :
$L_{Aeq,T}$: Equivalent continuous sound pressure level in 10 minutes
L_{pAi} : Average instantaneous sound pressure level in 5-second interval interval

After the 10-minute L_{eq} value is obtained, then it is entered in the table. If the table data is complete by the Decree of the Minister of the Environment No. 48/MenLH/11/1996 concerning the Noise Level Standard, the average value of the daytime L_{eq} measurement (Ls) will be obtained.

L_{eq} (siang) = L_s (16 jam) = $10\log_{10}\left[\frac{1}{16}\left(\sum_{i=1}^{4} t_i . 10^{Li/10}\right)\right]$

L_{eq} (malam) = L_m (8 jam) = $10\log_{10}\left[\frac{1}{8}\left(\sum_{i=5}^{7} t_i . 10^{Li/10}\right)\right]$

L_{eq} (malam) = L_m (8 jam) = $10\log_{10}\left[\frac{1}{24}\left(\sum_{i=5}^{24} t_i . 10^{Li/10}\right)\right]$ atau

L_{eq} (24jam) = L_{sm} = $10\log\left[\frac{1}{24}\left(16x10^{0,1xLs} + 8x10^{0,1x(Lm+5}\right)\right]$

Information :
L_{eq} : Noise equivalent [dB(A)]
L_i : L_{eq} at a certain time interval
L_s : Noise level during the day

The standard noise level is determined based on the Decree of the State Minister for the Environment of the Republic of Indonesia Number: Kep. 48/ MENLH /11/1996

Figure 1. Site Plane Sultan Syarif Qasim II Airport Pekanbaru

Data was obtained by measuring directly in the field, namely measuring the intensity of Noise using a Sound Level Meter which was carried out for 8 hours, namely between 07 : 00 – 17 : 00 WIB. Sampling was carried out for 24 hours (L_{sm}) at an interval of 06 : 00 – 06 : 00 WIB. The measurement time is divided into three times (*L1 – L7*). The distribution can be seen in the following table

RESULTS

Sultan Syarif Kasim II Airport is located in Pekanbaru, Riau Province. The airport coordinate system position is determined from the reference point of the airport coordinate system (the intersection of the X axis and Y axis) which is located in geographic coordinates. 000 28’ 15,849” North latitude and 1010 26’ 179” East longitude or at airport coordinates X = 20,000 meters and Y = 20,000 meters. (Regulation of the Minister of Transportation No. KM 3 of 2008)

Table 1. Distance of Research Locations

No	Noise Measurement Point	Information
1	North Runway	20 meters from the airplane runway
2	South Runway	20 meters from the airplane runway
3	East Apron	Airport apron area 250m from the airplane runway
4	South Apron	Airport apron area 250m from the airplane runway
5	Parking area	500m from the airplane runway
6	Northern settlement	250m from the airplane runway
7	Southern settlement	350m from the airplane runway

Table 2. Value of Measurable Meteorological Conditions in Residential Areas

Meteorological conditions	
Temperature (^{0}C)	26.4 – 35,8
Humidity (%)	47.6 – 88,4
Wind velocity (m/s)	0,0 – 3,1
Dominant wind direction	Southeast

Source : Weather Pro

Table 3. Value of Measurable Meteorological Conditions in Airport Area

Meteorological conditions	
Temperature (^{0}C)	28,3 – 34,9
Humidity (%)	55,0 – 95,0
Wind velocity (m/s)	0,1 – 3,0
Dominant wind direction	Southeast

Sound level measurements in settlements were carried out on Monday, July 22, 2019 in residential areas around Sultan Syarif Kasim II International Airport spread over 2 points. Meanwhile, measurements in the airport area were carried out on Monday, July 26, 2019. Sound pressure level data (Lp) was measured every 5 seconds for 10 minutes in the range generated at one measurement point of 120 data

Table 4. Recapitulation of L_p Value of Measurement Results in Housing

Measuring Point	LP value (dBA)							
PS	MIN	49,5	69,0	60,9	71,7	70,0	69,4	45,4
	MAX	87,3	76,1	85,1	84,9	89,3	81,1	88,4
PU	MIN	47,1	70,1	71,0	71,0	49,1	71,2	52,8
	MAX	84,8	77,4	79,4	79,4	73,9	77,9	75,9

Information :
Northern Housing
Southern Housing

The results of the calculation of Leq, Ls, Lm, Lsm in residential areas and those in the airport area at each measurement time can be seen in the table below

Table 5. Recapitulation of L_p Value Results Measurement at Airport

Measuring Point	LP value (dBA)				
		L1	L2	L3	L4
LPU	MIN	36,9	40,1	45,6	44,4
	MAX	96,9	98,3	99,0	102,6
LPS	MIN	45,9	40,2	50,2	43,0
	MAX	115,5	106,2	110,9	114,9
AT	MIN	65,8	69,3	66,3	57,9
	MAX	90,4	93,0	119,0	90,1
APK	MIN	52,4	45,8	52,8	48,9
	MAX	89,0	88,9	79,8	80,9

Information :
LPU : North Runway
LPS : South Runway
APK : Vehicle Parking Area
AT : East Apron
AS : South Apron

Table 6. Recapitulation of Noise Levels in Residential Areas

Measuring Point	Calculation L_{eq} (dBA)						
	L_{eq} 1	L_{eq} 2	L_{eq} 3	L_{eq} 4	L_{eq} 5	L_{eq} 6	L_{eq} 7
Southern Housing	65,71	70,93	71,56	79,06	73,94	72,49	66,12
North Housing	41,14	72,59	74,42	74,42	56,56	74,223	70,06

Source : Analysis Results

Table 7. Recapitulation of L_s, L_m, L_{sm} values in Noise in the airport area

Measuring Point	Calculation L_{eq} (dBA)			
	L_{eq} 1	L_{eq} 2	L_{eq} 3	L_{eq} 4
North Runway	85,95	79,42	80,49	81,56
South Runway	91,59	77,86	87,06	89,40
East Apron	80,95	81,16	96,37	80,19
Vehicle Parking Area	71,98	71,89	69,36	68,77

Source : Analysis Results

In the current study, referring to the standard noise level that is used as a reference is the Decree of the State Minister of the Environment No. KEP-48/MENLH/11/1996 Regarding Noise Level Standards. Based on this regulation, the standard noise level for residential areas is 55 dBA, and the allowable tolerance value is +3 dBA.

Table 8. Comparison of L_{sm} with Standard Noise Levels

Sampling Point	L_{sm} (dBA)	Quality standards (dBA)	Tolerance (dBA)	Information
Southern Housing	75,69	55	+3	Exceed
Northern Housing	73,43	55	+3	Exceed

Source : Analysis Results

Based on the results of the comparison of the Lsm value with the noise level standard for residential areas around the Sultan Syarif Kasim II International Airport, it exceeds the specified quality standards, this is because the residential area is close to the south runway and north runway.

The maximum noise level that is allowed in the workplace is 85 dBA for 8 hours referring to the Decree of the Minister of Manpower No. KEP-51/MEN/1999. The following is the result of calculating the length of exposure to Noise that is allowed for 8 hours per day:

Table 9. Allowable Noise Exposure Duration

Measuring Point	Average Noise (dBA)	T (Hour)
North Runway	89,57	3,1
South Runway	90,00	3,1
East Apron	80,00	25,3
Vehicle Parking Area	70,00	26,0

Source : Analysis Results

CONCLUSION

The highest noise level in the Sultan Syarif Kasim II International Airport area is on the East Apron at 99.50 dBA. This is due to the addition of construction around the apron. Meanwhile, the lowest noise level is in the vehicle parking area, which is 70.90 dBA. the highest noise level in residential areas around the airport is at the southern residential point of 75.69 dBA. At the same time, the lowest is in the northern settlements of 73.43 dBA. The high level of Noise in the residential area is caused by flight activities when the plane takes off or lands. The noise level in residential areas around the Sultan Syarif Kasim II International Airport in Pekanbaru has exceeded the acceptable noise level quality standard, which is 55 dBA with a tolerance of +3 db a. Based on a questionnaire survey that has been conducted in residential areas around the Sultan Syarif Kasim II International Airport Pekanbaru, on average, people feel very disturbed by the Noise caused by airport activities.

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