UNIVERSITI TEKNIKAL MALAYSIA MELAKA

STUDY ON THE USE OF STATISTICAL APPROACH TO ASSESS ENVIRONMENTAL NOISE POLLUTION FROM BATU BERENDAM INDUSTRIAL ESTATE MELAKA

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Mechanical Engineering Technology (Maintenance Technology) with Honours.

by

ASYRAF BIN AYUB

B071310625

940323-14-6793

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TAJUK: **STUDY ON THE USE OF STATISTICAL APPROACH TO ASSESS ENVIRONMENTAL NOISE POLLUTION FROM BATU BERENDAM INDUSTRIAL ESTATE MELAKA**

SESI PENGAJIAN: **2016/17 Semester 1**

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I hereby, declared this report entitled "Study on The Use of Statistical Approach to Assess Environmental Noise Pollution from Batu Berendam Industrial Estate Melaka" is the results of my own research except as cited in references.

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APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfilment of the requirements for the degree of Bachelor of Mechanical Engineering Technology (Maintenance Technology) with Honours. The member of the supervisory is as follow:

(Muhamad Azwar Bin Azhari)

ABSTRAK

Hari ini, banyak pentaksiran telah dilakukan terhadap kebisingan di persekitaran di serata tempat untuk mengenalpasti tahap kebisingan dan cara-cara untuk mengatasi pencemaran kebisingan ini. Kawasan Perindustrian Batu Berendam, Melaka adalah sebuah kawasan industri yang berkembang maju, namun tidak pernah menjalani sebarang pentaksiran kebisingan. Demikian, perkenalan kaedah pengukuran secara in-situ untuk menilai kebisingan di kawasan tersebut dipercayai penting untuk mengenalpasti tahap kritikal kebisingan di persekitaran kawasan tersebut. Oleh itu, kajian ini memfokuskan terhadap pentaksiran kebisingan di persekitaran dari Kawasan Perindustrian Batu Berendam, Melaka dengan menggunakan pendekatan statistik. Kaji selidik dan pengumpulan data kebisingan adalah merangkumi separuh Kawasan Perindustrian Batu Berendam pada 50 tempat penilaian yang berbeza dengan menggunakan meter tekanan bunyi. Kebisingan yang dikumpul telah disusun, dijadualkan dan dipencirikan dengan menggunakan 'Microsoft Excel'. Hasil daripada analisis dan perincian menunjukkan kebisingan paling lantang di rekodkan adalah 88.7 dB(A) dan yang terendah adalah 54.3 dB(A). Faktor-faktor kebisingan telah dikategorikan kepada 5 kategori utama iaitu Elektronik, Pejabat, Pembuatan, Pembinaan dan Lain-lain. Tapak Pembinaan dikenalpasti sebagai kawasan yang paling tercemar oleh kebisingan di persekitaran dan kawasan pejabat adalah kawasan yang paling selamat dari dicemari oleh kebisingan di persekitaran. Jadi, boleh disimpulkan bahawa peta bunyi Kawasan Perindustrian Batu Berendam, Melaka telah berjaya dihasilkan berdasarkan pencirian dan pengiraan kebisingan dengan menggunakan pendekatan statistik.

ABSTRACT

At present, many assessments have been done regarding the environmental noise on many places to determine the noise level and ways to prevent the noise pollution. Batu Berendam Industrial Estate, Melaka is a well-developed industrial region but however, has never undergo any noise assessments. As such, introduction of the in-situ measurement to evaluate noise in the region is deemed necessary in order to determine the criticality of the noise level in the estate. Therefore, this study focuses on assessing environmental noise pollution from Batu berendam Industrial Estate, Melaka by using statistical approach. The survey and noise data collection were covering half of Batu Berendam Industrial Estate in 50 different points of by using sound pressure meter. Noise collected were rearranged, tabulated and characterized by using Microsoft Excel. The result of analysis and characterization shows the highest environmental noise recorded is 88.7 dB(A) and the lowest is 54.3 dB(A). The noise factors are categorized into 5 main types which are Electronics, Offices, Manufacturing, Constructions and Others. The Constructions site is identified as the most polluted region by environmental noise and the Offices are the safest region from being polluted by environmental noise. Thus, it can be concluded that the noise maps of Batu Berendam Industrial Estate, Melaka, has successfully been produced based on the characterized and calculated noises by using statistical approached.

DEDICATIONS

This report is dedicated to my family and friends, also to the future generation that will need to use the idea of this project for next studies.

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I am most grateful to Almighty God, Allah S.W.T., for giving me strength to complete this Projek Sarjana Muda (PSM). I would like to express my deepest gratitude firstly towards my supervisor Mr. Ahmad Yusuf Ismail from the Faculty of Engineering Technology, Universiti Teknikal Malaysia Melaka (UTeM), for his excellent supervision, guidance and encouragement on us in order to complete the project For Bachelor Degree of Engineering Technology, Bachelor's Degree of Mechanical Engineering Technology (Maintenance Technology) (Hons.), Universiti Teknikal Malaysia Melaka.

Secondly, I would like to express out grateful thanks for my parents for giving me supports in various aspect especially in aiding me to complete this report. Also, special thanks awarded to friends that always give a helping hand to give ideas to make this report completed. Thank you.

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LIST OF ABBREVATIONS, SYMBOLS, AND NOMENCLATURE

+	-	Plus
Π	-	Pi
Δ	-	Amount of Changes
μ	-	micro
ABPM	-	Ambulatory Blood Pressure Monitoring
dB (A)	-	decibel units for A-weighting
dB	-	decibel
DNL	-	sound pressure for day and night
EMPCA	-	Environmental Management pollution control act
EPA	-	Environmental Protection Agency
GIS	-	Geographical information system
GPS	-	Global Positioning system
Hz	-	Hertz
ISO	-	International Standard Organization
km	-	kilometre
L_{EX}	-	Noise exposure level
L_{eq}	-	steady equivalent sound pressure
Lg	-	log
L_{oi}	-	average noise emission level for vehicles type i
L_p	-	sound pressure
L_{pa}	-	sound pressure for A-weightings
m	-	metre
NGO	-	Non-Government Organization
Ni	-	traffic volume of vehicles type i
NIHL	-	Noise Induced Hearing Loss
NT EPA	-	North Territory of Environmental Protection Agency
OSHA	-	Occupational Safety and Health Administration
P	-	Pressure

Pa	-	Pascal
Pref	-	References pressure
r	-	radius
sec	-	second
SPL	-	Sound Pressure Level
T	-	Calculation time
UTeM	-	Universiti Teknikal Malaysia Melaka
Vi	-	speed of vehicles type i
WHO	-	World Health Organization

CHAPTER 1
INTRODUCTION

1.1 Background

Noise is defined as undesirable sound that is unwanted to be produced. A high frequency of sound can be harmful and it is also sometimes called as noise regardless of its other characteristics (Liu and Robert, 1999) Noise can also be distinct as a signal of spurious seismic that not associated with reflection that comes from the ground. In spite of that, in the study of Scales and Snieder, (1998) identify that the noise as a signal that is uninterested. From past studies, it has proved that noise is a type of sound or acoustic that produced by the environment or instrument that is unwanted and need to be desperately removed as it can bring hazard to health and social. A research from Brüel and Kjær (2000, 2001), shows that there are many actions to encounters the environmental noise problem has been issued is most of countries such as building new developments to residential, measuring the compliance from noise sources (industrial plants, airplane and airports, traffics, etc) and deliberate with complaint from residents.

According to Brüel and Kjær (2000, 2001), an average person's threshold of hearing is about 20 μPa but the threshold of pain is about 100 pa and thus, the differences between these two values sum up the pain that a person would experience if the sound pressure is too high. Based on study of Hammer, et al. (2014), it is estimated that about nearly 100 million people in the United States in 1981, will affected with a harmful health when exposure to traffic noise by U.S. Environmental Protection Agency (EPA). Moreover, noise can also cause hearing deficiency as the effect of its pollution to the human health (Liu and Robert, 1999). Other than that, the excessive limits of noise can also lead to more serious illness to human health

including insomnia, irritation, hearing impairment an could also damage the certain hormones in human body such as endocrine effect that uncertainly increased the diabetes occurrences among citizens (Vermeer et al., 2000).

Noise can be found everywhere regardless by industrial or by natural. Sometimes, noise can be louder when affected by the environment and surrounding such as railways, traffics, the airplanes and industries (Liu and Roberts, 1990). Figure 1.1 shows the sound level noise produce by the factor of railway. Upon noise produced, there are several factors that contribute to the excessive noise level as such industrial environmental noise. According to Zannin et al.(2002), the environmental noise in industries is affected due to such factor which is increasing number of immigrant in urban residential, rise number of vehicles and heavy working industries developed in urban areas. A research by Cai et al, (2015) stated that the traffic noise has become one of primary urban environmental noise pollution. This pollution gives huge impact in affecting those residential by negatively increase stress, emotion and easily annoyed (Zannin et al., 2002).

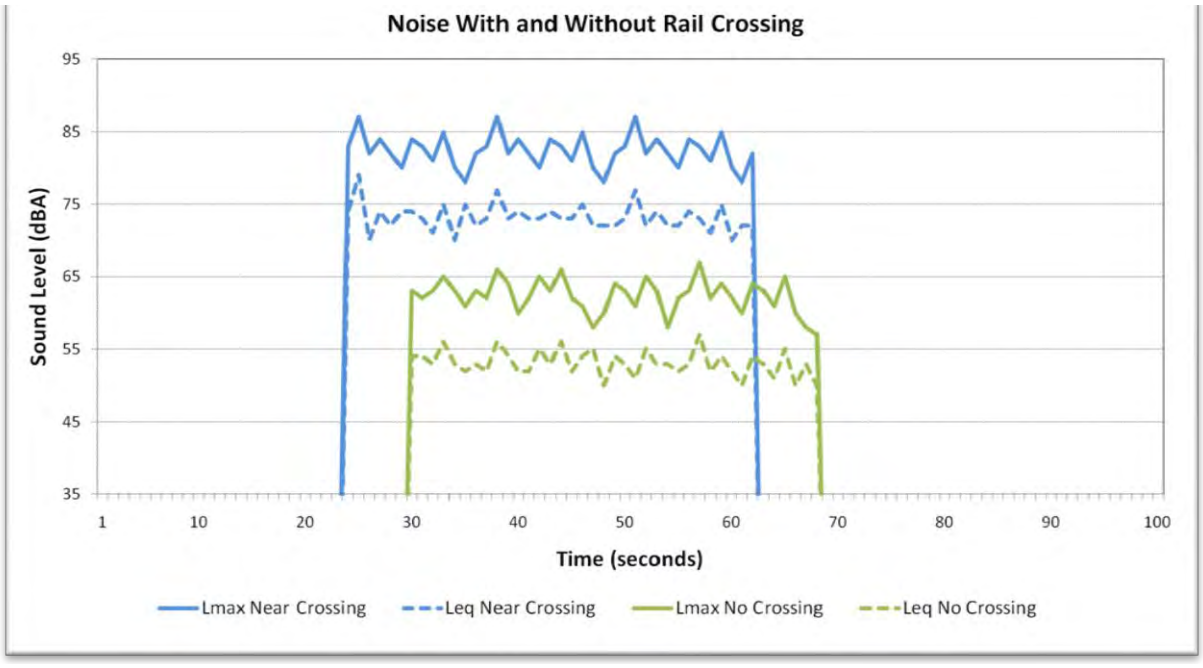

Figure 1.1: Noise With and Without Rail Crossing (Minister of Public Works and Government Services Canada, 2011)

There are a few types of noise characterized into the science study. There are several types of noise to be recognized in research by Brüel and Kjær (2000, 2001), that is continuous noise, emitted noise and impulsive noise. Noise area also been categorized into several types as such the environmental noise is one of it. The environmental noise is the one that been crucial in the field of science (Zannin et al., 2002). A research from Singh and Davar, (2004) stated that the source of environmental noise emitted from transportation an industry. In spite of that, a study from Zannin et al., (2007) claimed that environmental noise is various sources as such agreed with previous research that the source is from industrial noise. Figure 1.1 shows the sound level noise produce by the factor of railway.

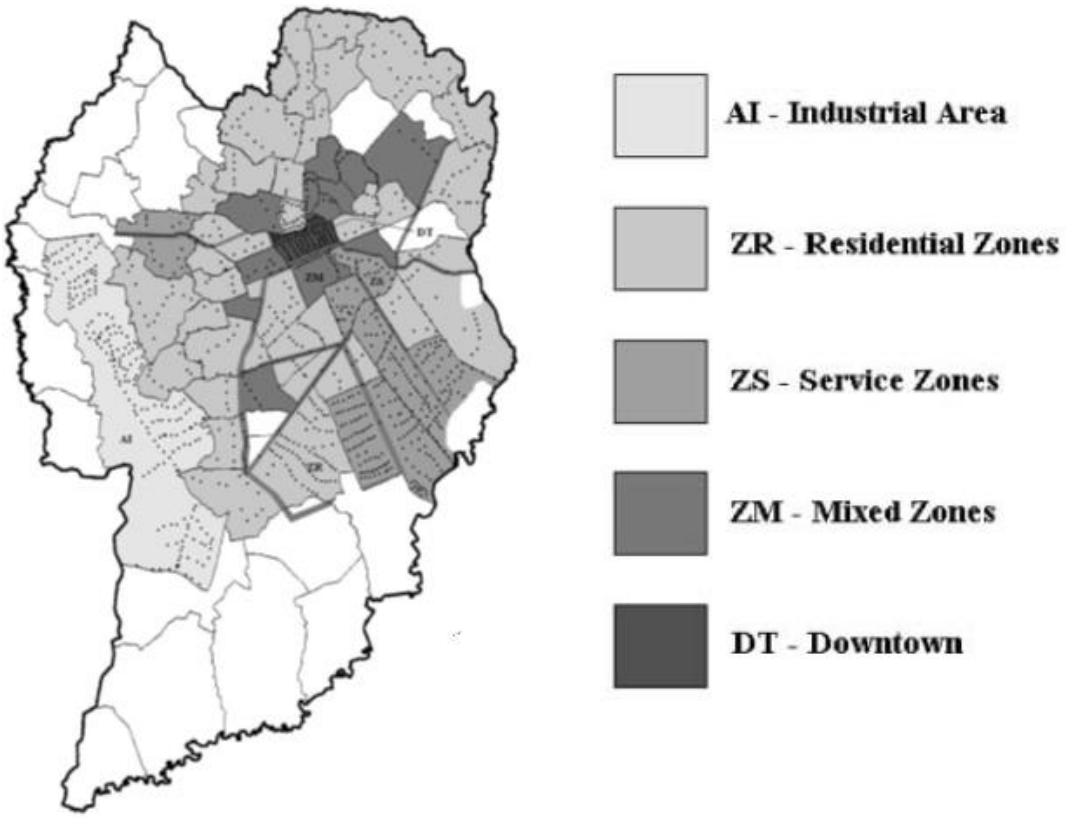

Figure 1.2: Noise Maps on City of Curitiba, Brazil (Zannin Et Al., 2002)

Environmental noise also recognized to give negative impact to residential health if not being treated well before it worsens (Morillas et al., 2002). Environmental noise pollutions are divided into certain sush shown in Figure 1.2 that is industrial, residential, mixed services and downtown (Zannin et al., 2002). A study from Cai et al, (2014) claimed that environmental noise are also produced by road

traffic. From the research, the result found that the main contributor to the environmental noise is the road traffic noise. Other than that, there are a few cases where the environmental noise from airplanes and airports (Brüel and Kjær, 2000, 2001). In cases of noise pollution emits by industrial estate, the noise varies in term of differences frequencies (Liu and Roberts, 1999).

The industrial noise has several types of characteristic that are differs by its magnitude of loudness, uniformity and component frequencies (Liu and Roberts, 1999). The characteristic of frequency components varies the noise emits by the types of machinery used. Large machinery produces such low-frequency noises and vice versa (Liu and Roberts, 1999). Plus, in the field of industry, it is often uses the rotating and reciprocating machinery and tools especially motor and generators that produce higher frequency than usual. As studied by (Liu and Roberts, 1999), the source of noise pollution in industrial estate is attained by the vibration, imbalanced and bearing defects. As such noise can also be produced from the electrical machines that cyclically change the magnetic forces and cause propagation on the machine part, thus, producing unwanted noise pollution and vibration.

1.2 Problem Statement

Environmental noise in Malaysia has been recognized for a long time ago. Ever since that, the problem of this noise pollution has not been highlighted by any authorities because it has not shown any of the problems regarding health to the residential nearby the industrial estate. However, the environmental noise pollution especially on the industrial estate can cause several short-term and long-term diseases and can become harmful if not been encounters at the earlier stages. An urban area and city needed to conduct an assessment of environmental noise annually at least to determine the noise level at the region. This is because the environmental noise is developing each year due to factors such population density, development of industries, local habits and culture (Morillas et al., 2002). In case of environmental noise pollution that occurs at the industrial estate of Batu Berendam, Melaka, there have never been any steps and solution taken to encounters this problems. Therefore,

the environmental noise assessment at Batu Berendam industrial estate of Melaka does not exist.

The problems of environmental noise pollution at this industrial estate may worsen because the region is under urban areas and can highly be harmful to the residents. Based on the reports by Dickens et al., (2014) most city and urban area that experiences environmental noise pollution suffers disturbances in having sleeps, emotionally annoyances, hypertensions, and a few problems that related to hearing impairments. Besides, the negative impact of environmental noise are also affecting life quality and productivity (Zannin et al.,2002). This is because the degree of sound pressure emitted by the industrial estate exceeding normal hearing threshold. According to Zannin et al, (2002), the normal threshold of hearing that is acceptable is below than 49 dB(A) and it is clearly unacceptable at above 76 dB(A). These problems can be encounters by reducing the noise received by the residents. However, there are a few of method can be used to collect and measure the noise pollution at the industrial estate of Batu Berendam, Melaka. This report is focusing on assessing the environmental noise pollution by using statistical approach at the industrial estate and producing appropriate noise maps.

1.3 Objective

1. To measure environmental noise and produce noise mapping for Batu Berendam industrial estate, Melaka.
2. To characterize the environmental noise by using statistical approach

1.4 Scope

1. Measuring the environmental noise at Batu Berendam, Melaka industrial estate by using sound level meter.
2. Producing the noise mapping based on the data measured and collected.
3. Characterizing the environmental noise by using statistical approach by Microsoft Excel.

CHAPTER 2
LITERATURE REVIEW

2.1 Factor of Environmental Noise

Noise is often described as unwanted sound produced by human daily activities, construction transport and even machinery. Even in Latin word, noise is defined as nausea which means unwanted or loud, unpleasant and unexpected sound (Singh and Davar, 2004). According to Eade et al., (1999), noise transmits through the air to the environment. The development of environmental noise is contributed by several factor which is aircraft, traffic, community, neighbourhood, railway, occupational, construction and industrial.

2.1.1 Aircraft Noise

People are exposed to the aircraft noise every day without realizing the hazard of it. Noise from the aircraft does not limited to only the plane in the air itself, but also considered as noise from all of it surrounding including noise from airports, vehicles and rail (Southgate et al., 2000). Precisely, the aircraft noise has different noise level at different stages. As examples, the noise level during its arrival is far quieter than its departure at the same altitudes also it part such as auxiliary power units, engines, exhaust, is all in different noise pressure level.

People that suffered this high level noise are highly exposed to health risk and many diseases involving critical noise level (Clark, 2015). Aircraft noises are often monitored in DNL (Day-Night Sound Level), which represents noise exposure events over a 24-hour period. Aircraft noise is

different from other environmental noise as it officially has its own noise contour maps as shown in Figure 2.1. This noise contours functions to highlight the area that exposed the most by aircraft noise and usually described in 65 dB(A), 70 dB(A), and 75 dB(A) and to assess the relative aircraft noise exposure levels of different runway and flight corridor alternatives.

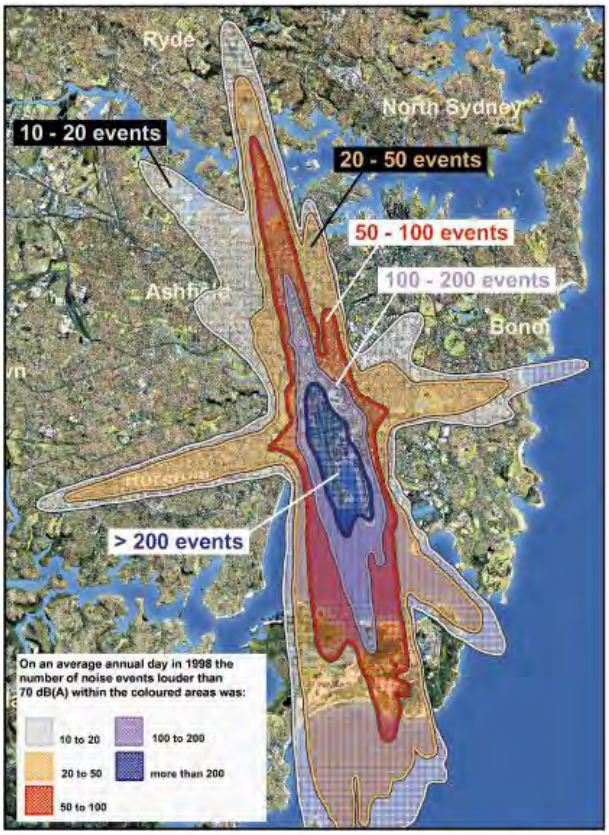

Figure 2.1: Noise Contour Maps (Mike, 2000)

2.1.2 Traffic Noise

Traffic noise is often claimed as the top contributor towards the environmental noise pollution. Even small town that does not have high development in industrial field experienced development. Several study from previous research stated that the traffic noise is higher neither during daytime nor night compared to other noises. . A study by Zannin et al., (2002), shows that the traffic noise is the main contributor to the environmental noise as it