CHAPTER 2

LITERATURE REVIEW

2.0 INTRODUCTION

Noise is commonly defined as unwanted sound (Bugliarello (1976), Watkins (1981); Kuwano et. al., (1991)). Noise is an environmental phenomenon to which we are exposed from birth and throughout life. Noise can also be considered an environmental pollutant, generated with human activities. Noise is defined as any sound that can produce an undesired physiological or psychological effect in an individual and that may interfere with the social ends of an individual or group. These social ends include all of our activities - communication, work, rest, recreation and sleep.

As waste products of our life, we produce two general type of pollutants. The general public has become well aware of the first type - the mass residuals associated with air and water pollution - that remain in the environment for extended periods of time. However, only recently has attention been focused on the second general type of pollution, the energy residuals such as the waste heat from manufacturing processes that creates thermal pollution of our streams. Energy in the form of sound waves constitutes yet another kind of energy residual, but, fortunately, one that does not remain in the environment for extended periods.

Noise is quite subjective as it may be music to someone's ear and merely a noise to others (Stockfelt, 1991). No one can escape noise on this planet which is a disturbance to the environment and is escalating so rapidly. The peace of the countryside and the natural sounds of the jungle have been replaced by the internal combustion engine of vehicles. Even in the homes, more and more power gadgets surround us, each a source of noise.

Slowly and insensibly we seem to accept noise and the physiological and psychological deterioration that accompanies it as an inevitable part of our lives. Unfortunately, in this technological world, there is no hope that noise will vanish by a technical breakthrough, if only because there is no such thing as a noiseless machine. Of the energy put in to run a machine, some must come out as noise even if it is a very small fraction. An automobile may have an energy input of 100kW. Of that, only one part in a million or 0.1 W comes out as noise.

Traffic noise is increasing plainly due to the fact that internal combustion engines are becoming more powerful and the number of vehicles are also rising to meet the demand of the increasing population.

Noise has not been a major concern as water and air pollution. This is because water and air pollution pose obvious and immediate danger to health whilst noise is a long term effect and cannot be seen immediately.

The total amount of energy dissipated as sound throughout the earth is not large when compared to other forms of energy. It is the extraordinary sensitivity of the ear that permits such a relatively small amount of energy to adversely affect us and other biological species.

Noise of sufficient intensity and duration can induce temporary or permanent hearing loss, ranging from slight impairment to nearly total deafness. Generally, a pattern of exposure to any source of sound that produces high enough levels can result in temporary hearing loss. If the exposure persists over a period of time, this could lead to permanent hearing impairment. Short term but frequently serious, effects include interference with speech communication and the perception of other auditory signals, disturbance of sleep and relaxation, annoyance, interference with an individuals ability to perform complicated tasks and general diminution of the quality of life.

Beginning with the technological expansion through the years since the Industrial Revolution, more geographic areas are becoming exposed to significant levels of noise. Where once noise levels sufficient to induce some degree of hearing loss were confined to factories and occupational situations, noise levels approaching such intensity and duration are today being recorded on urban streets.

2.1 CONTRIBUTORS OF TRAFFIC NOISE

The economic progress and industrialization process in the past 5-10 years have increased the number of vehicles in this country. Most of the working people in the urban areas could afford to own a car. In the year 1989, statistics showed that there was one car for every 4 person (Khairani, 1993).

Heavy vehicles such as trucks have also increased due to the increase in transportation of goods from the industrial, commercial and constructional sectors. The number of buses has also escalated to cater for the increasing number of people and tourist travelling within the country.

According to Khairani (1993), increase in the number of vehicles is due to the industrialization process and the existence of the car manufacturing industry in Malaysia. A report by the Road Transport Department in 1990, indicated an increase of 1.5-2% every year in the ownership of private cars, motorbikes, van, lorry and bus.

There are no signs of reduction in the number of vehicles. It is estimated that the number will continue to increase into the millennium. This is all closely related to the increase in the affluence of the society, increase in population, the mobility of individuals and the ability and status of owning a car (Renner, 1990).

2.2 BASIC DEFINITIONS OF NOISE

Sound

Noise is a form of energy which travels in a series of waves and the pressure difference causes the ear to hear sounds. The number of cycles per unit time of the waves defines the frequency of the sound. The most common unit of sound frequency is the cycles per second (cps) which is also called Hertz (Hz). The ear of a normal adult human has the ability to hear a very broad spectrum of frequencies from 20 – 20,000 Hz. The ear is more sensitive at frequencies 2khz to 5khz.

The sound levels often useful in defining noise exposure is : the L10 level, the noise level in dB(A) exceeded only 10 percent of the time. The Leq is the equivalent noise level which is the mean square level of a sufficiently long sample of noise (in dB(A)) relative to a 20 micronewtons per square meter per second.

The unit dB(A) is used in measuring the noise levels. This dB(A) unit means 'decibel – A weighted which is a unit which is corrected at A weighted scale by using a reference pressure at 20 micropascal (Environmental Quality Act, 1974 (Act 127)).

Vehicular Noise

The sources of vehicle noise are from the engine, inlet, exhaust, fan, transmission, road surface, tyres and brakes. For a vehicle travelling at moderate to high speeds on dry roads, the noise increases with speed at between 6 and 12 dB(A) per doubling of speed (Harland, 1974).

2.3 EFFECTS OF NOISE ON HUMAN HEALTH

The effects of noise on human can be classified under two categories i.e auditory effects and psychological/sociological effects. Auditory effects include both hearing loss and speech interference. Psychological/sociological effects include annoyance, sleep interference, effects on performance and acoustical (Schell, 1991).

Exposure to noise of sufficient intensity for long periods of time can produce detrimental changes in the inner ear and seriously decrease the ability to hear

The Hearing Mechanism

Anatomically, the ear is devided into three sections i.e the outer ear, the middle ear and the inner ear. The outer and middle ear serve to convert sound pressure to vibrations. They also protect the ear by keeping debris and objects from reaching the inner ear.

The outer ear, eardrum and middle ear are almost never damaged by exposure to intense noise, although the eardrum can be ruptured by extremely intense noise and blasts. The primary site of auditory injury from excessive exposure to noise is the receptor organ of the inner ear.

The inner ear consists of a canal filled with lymphatic fluid coiled up in the shape of a spiral, surrounded by the extremely hard temporal bone. The receptor organ in the inner ear is the corti. The auditory sensory cells and the auditory nerve fibers are attached to it. The corti is in turn fixed to the basilar membrane. As the basilar membrane is driven up and down by sound, a shearing movement is generated between the tectorial membrane and the top of the organ of corti. This movement bends the hairs at the top of the hair cells. This bending, in turn, causes the hair cells to stimulate the auditory nerve fibers. As a result, nerve impulses arise in the nerve fibers and travel to the brain stem. From the brain stem the nerve impulses are relayed to various parts of the brain gives rise to auditory sensations.

Normal Hearing

The ear of the audiometrically healthy, adult male responds to sound waves in the frequency range of 20 to 16,000 Hz. Young children and women often have the capacity to respond to frequencies up to 20,000Hz. The speech zone lies in the frequency range of 500 to 2,000 Hz. The ear is most sensitive in the frequency range from 2,000 to 5,000 Hz.

2.4 TRANSPORTATION NOISE

For most automobiles, exhaust noise constitutes the predominant source for normal operation below 55 km/h. Although noise from tires is much less of a problem in automobiles than in trucks, it is the dominant noise source at speeds above 80km/h. Even though it is not as noisy as trucks, the total contribution of automobiles to the noise environment is significant because of the very large number in operation. High speeds of vehicles and roads with bends are main sources of traffic noise (Nilsson, 1991).

Diesel trucks are 8 to 10 db noisier than gasoline-powered ones. At speeds above 80km/h, tire noise often becomes the dominant noise source on the truck. Motorcycle noise is highly dependent on the speed of the vehicle. The primary source of noise is the exhaust. The noise spectra of two-cycle and four-cycle engines are of some what different character. The two-cycle engines exhibit more high frequency spectra energy content (Watkins, 1981).

2.5 AIRBORNE TRANSMISSION

Effects of atmospheric conditions

Sound energy is absorbed in quiet isotropic air by molecular excitation and relaxation of oxygen molecules and, at very low temperatures, by heat conduction and viscosity in the air. Molecular excitation is a complex

function of the frequency of noise, humidity and temperature. In general, we may say that as the humidity decreases, sound absorption increases. As the temperature increases to about 10 to 20 degrees C (depending upon the noise frequency), absorption increases. Above 25 degrees C, absorption decreases. Sound absorption is higher at higher frequencies (Makarewicz, 1993)

The vertical temperature profile greatly alters the propagation paths of sound. If a superadiabatic lapse rate exists, sound rays are bent back toward the ground. This results in an increase in the sound level. These effects are negligible for short distances but may exceed 10dB at distances over 800 m.

In a similar fashion, wind speed gradients alter the way noise propogates. Sound traveling with the wind is bent down, while sound traveling against the wind is bent upward. When sound waves are bent down, there is little or not increase in sound levels. But when sound waves are bent upward, there can be a noticeable reduction in sound levels.

2.6 LAWS GOVERNING NOISE POLLUTION

In Malaysia, noise pollution and its control is not very significant especially in terms of enforcement. There is only a few Acts in relation to noise such as under the factories and machinery, traffic noise and noise in

airports. The Department of Environment is currently drafting new guidelines for noise pollution and control in Malaysia.

Following are some of the Acts in relation to noise in Malaysia:

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The Department of Environment sets a standard of 65dB(A) for day and 55dB(A) for night time as boundary noise criteria for residential areas surrounding a project site.

2.7 TRAFFIC NOISE AND RESIDENTS

There are few or no studies regarding traffic noise and its effects on the residents, in Malaysia. For the past 25 years the Department of Environment Malaysia entrusted to protect the environment, has carried out surveys in several areas.

A survey carried out in 1993 showed that most of the urban areas such as Kuala Lumpur, Johor Bahru, Shah Alam, Petaling Jaya, Alor Setar , Pulau Pinang, Ipoh and Kelang, have traffic noise above the 55 dBA level set by WHO.

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