The Effect of Road Traffic Noise at Hospitals in Baghdad City

Asst. Lecturer. Zeena T. Jaleel
University of Technology
Building & Construction Eng. Department

Abstract

Noise is a prominent feature of the environment.of all the sources of noise pollution, road traffic is the most prevalent and perhaps damaging source of noise pollution. The objectives of this study are to investigate the level of noise pollution which comes from traffic near Al- Wasity, Al-Elwayia and Zayed hospitals in Baghdad city. An instrument for the measurement of noise level was used on noise pollution was administered. Measurements of noise level were carried out on daily basis from (1-17) November and December during working days, also traffic volume was taken manually from 7:30 am to 2:30pm for the intersection in the study area and near the hospitals. HCS computer program was used to evaluate the level of service for these areas near the hospitals and the result show that the level of service was F. The daily averaged noise levels measurement inside and outside the hospital during day time were so high than the current day time environmental noise limit requirement according to Guid line. Finally some suggestion was given to reduce the noise level in this area.

Key words: Traffic noise, Traffic volume, Hospital.

تأثير ضوضاء الحجوم المرورية على المستشفيات في بغداد

م.م. زينة طارق جليل
الجامعة التكنولوجية/ قسم هندسة البناء والإنشاءات

الخلاصة:

تعتبر الضوضاء من المعالم الواضحة في دراسة البيئة . من بين جميع مصادر الضوضاء تعتبر الضوضاء الناتجة من حركة النقل البري هي السائدة والاكثر ضررا من بين جميع مصادر الضوضاء. الهدف من هذا البحث هو دراسة مستوى الضوضاء نتيجة الحجوم المرورية القريبة من عدد من المستشفيات في بغداد حيث تم اختيار احدى الشوارع في مدينة بغداد و التي تقع فيها مستشفى الواسطي و العلوية ومستشفى زايد.تم استخدام جهاز الكتروني خاص لقياس مستوى الضوضاء داخل وخارج مواقع محددة في المستشفى حيث تم حساب مستوى الضوضاء في ايام العمل اليومي من (1-17) تشرين الثاني و كانون الاول وايضا تم حساب كمية الحجوم المرورية في نفس الوقت عند قياس الضوضاء حيث تم حساب هذة الحجوم يدويا من الساعة 7 صباحا و لغاية 2:30 ظهرا و استخدم برنامج HCS لحساب مستوى الخدمة لهذة المنطقة وعند تحليل هذة الحجوم وجد ان مستوى الخدمة للطريق كان f وايضا الضوضاء نتيجة لذلك كانت عالية مقارنة مع الحدود العالمية للبيئة الخاصة بالمستشفيات. واخيرا تم اعطاء بعض المقترحات التي من ضمنها ان تقلل بعض الضوضاء في هذة المنطقة.

مفاتيح الرموز/الحجوم المرورية، ضوضاء المرور، مستشفيات

1. Introduction

Noise, defined as unwanted, is perceived as an environmental stress or nuisance. Noise is a prominent feature of the environment including noise from transport industry and neighbors. Noise interferes in complex task performance, modifies social behavior and ouses annoyance [1].

Noise pollution is by now worldwide recognized as a major problem for the quality of life in urban area. Vehicular traffic is the most important source of the environmental noise pollution in these areas. The increasing in the pollution and in the number of circulating vehicles has led to an increase in the noise pollution. Noise impaction mental and physical health and disturbance of daily activities. It may affect sleep, conversation; lead to perception of annoyance, causing hearing loss, cardiovascular problems as well as affects task performance [2].

Environmental problems in hospital are a serious issue. Her we will focus on one of these problems: Traffic noise, people at hospital needs rest more than anyone else. The presence of noise can be very harmful to the patients, hospital are intended to be places for the rest of ill or injured people [3].

The technical problems associated with the design of quite vehicles are still not solved; so is the confinement of the noise emitted by these vehicles within the limits of what is bearable. Another important element to be taken into consideration is the subjective human sensitivity to noise, which requires considerable noise reduction before benefits can be felt. In general every noise problems involves a system of three basic elements a sound source, a transmission path and a receiver, when possible, the best way to remedy exposure to undesirable noise, both economically and aesthetically is to control the noise emission at the source itself but for most noise sources, the most corrective measure is making change in the path, moreover different noise sourced may have different acoustical characteristics, while some generate a pure tone other may radiate a random noise while a more or less know frequency spectrum. So in this respect the definition of the noise problems is important. For traffic noise, an automobile has in general several noise generating sources, but because of commercial limitations and the very competitive car industry [4].

In contrast to many other environmental problems, noise pollution continues to grow, accompanied by an increasing number of complaints from affected individuals. Most people are typically exposed to several noise sources with road traffic noise being a dominant source. Population growth urbanization and large extent technological development are the main driving forces, and future enlargement of highway systems. Noise is not simply a local problem, but a global issue that affects everyone and calls for precautionary action in any environmental planning situation. So in this study we choose some hospital in Baghdad city which were in congestion area those are Al-Elwayia (A), Al-Wasity (B) and Zayed (C). **Figure (1)** shows the location of these hospitals and **Figure (2) And (3)** show the position and some details of the roads near the hospitals.

Fig .(1), Satellite Top View Image for Baghdad City illustrates the Selected Hospitals

Fig .(2), Satellite Top View Image for, Al-Elwayia Al- Wasity hospitals

Fig .(3), Satellite Top View Image for Zayed hospitals

2. Noise Characteristics and Measurement

Noise unwanted because it annoys interferes with conversation. Disturbs sleep, and in the extreme, is a danger to public health. Sound whether noisy or noiseless is produced by vibrations in air water, steel, or other substance. When an object vibration. It produces rapid small scale variations in the normal atmospheric pressure. Noise is characterized by its sound level its frequency spectrum and its variation over time. The term sound level refers to a physical measure that corresponds to the hearer‘s subjected conception of loudness. It is a function of the magnitude of the pressure fluctuation about the ambient barometric air pressure. One can speak of the strength of these fluctuations in terms of several variables the most common being sound intensity and sound pressure. Sound intensity (also called sound power density) is the average rate of sound energy transmitted through a unit area perpendicular to the direction of sound propagation, typically measured in pic watts (10^{-12} watt) per square meter. The human ear can detect sound intensities as weak as 1 picowat and tolerate intensities as high as 10 picowatts. Because of the difficulties of dealing with such a large range of numbers a logarithmic measure called the decibel (dB) is used to describe sound level. The sound intensity, expressed in decibels, is

$$Sound\ intensity = 1o\ log_{10}(I/I_0) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ (1)$$

Where I= sound intensity (picowatts/m^2)

I_0= 1 picowatts/m^2 a standard reference intensity representing approximately the weakest Audible sound

Sound level is measured by a sound level meter which consists essentially of a microphone that converts the pattern of sound pressure fluctuations into a similar pattern of electrical voltage, amplifiers, and a voltage meter that is normally calibrated to read in decibels. For practical purpose the decibel scale ranges from 0, the threshold of hearing to about 140 dB, the onset of pain. For every increase of about 10 dB, there is a doubling of the sounds apparent loudness.

A great many scales have been used to express noise levels. One of the simplest and most straight forward noise measurement techniques consist of measuring the overall sound pressure level that is related to the total sound energy over the audible frequency range. However, the unweight overall sound pressure level is not strongly correlated with a hearer’s subjective response to the noise. The A-weight sound level was devised to more closely represent a person’s subjective response to sounds. In the A- weighted filter network the lower frequencies are deemphasized in a manner similar to that of human hearing. The A-weighted sound level. Measured in decibels (dB A), is the generally accepted scale for measuring highway transportation noise [5].

3. Sources of Road Traffic Noise

The most important noises sources of noise are road traffic noise, aircraft, railway and industries noise in the community. Road traffic is by far the largest of these and accounts for about 78percent of noise annoyance [6], **Figure (4)** show the distribution of the different noise sources to which the general public is exposed. Noise from traffic can be classified into two types, 'bulk traffic flow noise' and 'intermittent traffic

Noise'. 'Bulk traffic flow noise' is from the combination of all noise from vehicles travelling along a road. At low traffic speeds, vehicle engines, transmissions, exhausts and brakes cause the majority of road traffic noise. As speed increases, noise from the interaction between tires and the road increases and at speeds in excess of approximately 70km/hr,this becomes the dominant component. Air disturbance by moving vehicles also becomes an important factor at higher speeds. 'Intermittent traffic noise' is caused by individual vehicles, is often noticed at night, and can cause sleep disturbance. Sources of intermittent traffic noise are [7]:

Heavy vehicles, which are inherently louder than
Cars and light vehicles;
modified cars and motorcycles;
noisy truck engine brakes;
noisy exhaust systems;
loud music from vehicles;
empty heavy vehicles (banging due to body
Panels and loose structures);
vehicle horns; and
driver behavior (for example, rapid Acceleration and sudden braking

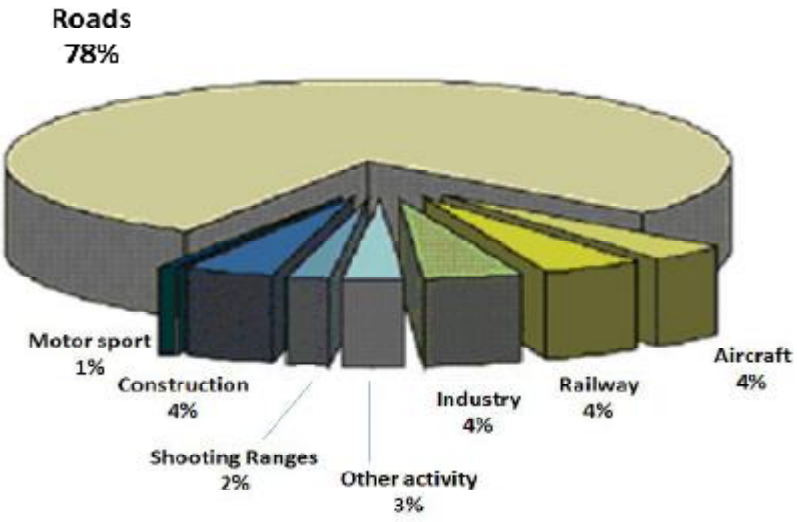

Fig .(4). Different Noise Sources [6]

4. Acoustical Characteristics of Road Traffic Noise

In the built-up environmental of the city, road traffic is the main source of noise. Under the plausible assumption that small vehicles are numerically the greatest contributor to urban traffic the noise generated by small vehicles is thought to have four different origins, the engine, the exhaust, the tires, and the air turbulence. Noise due to tire-road contact becomes significant only for relatively high driving speeds, so this is neghible at the limited car speed in a town. For the same reason, air turbulence also makes only a small contribution, so that only leaves the noise from the engine and the exhaust of the vehicles. There are two ways traffic noise can reach subjects living in an apartment with windows facing the street. One is that the waves generated by the vehicles are transmitted directly through the air to the windows of the residence, or that they cause vibration in the building. The other way is that the rolling tires of the vehicles induce vibration in the road beneath which when transmitted to the building through structure contact generate sound waves inside the building see figure 5 [4].

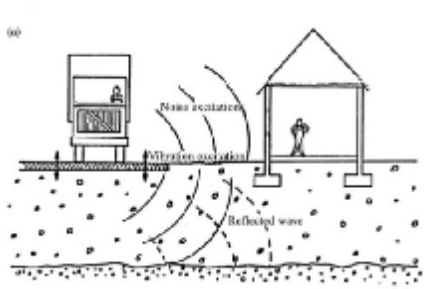

Fig .(5) The Different Ways Traffic Noise can reach the Inside of a Building. (Adapted from Nelson, 1987)

5. Health Effect of Noise

Patients often complain about the amount and level of noise they hear during hospitalization. The near-constant din created by equipment, hallway traffic, and conversation results in a less than- restful experience for many. And the effects can be detrimental; studies in adult patients have linked excessive noise to sleep disturbance, and increased blood pressure, heart rate, and stress. Excessive noise and inadequate sound isolation can interfere with patients' auditory or "speech" privacy—which by law hospitals and other health care's facilities must safeguard.

5.1 Specific Environmental In Hospitals

For most spaces in hospitals, the critical effects are sleep disturbance, annoyance, and communication interference,

Including warning signals. The LA max of sound events should not exceed 40 dB (A) indoors. For ward rooms in hospitals, the guideline values indoors are 30dB LAeq, together with 40 dB LAmax during night. During the day and evening the guideline value indoors is 30 dB LAeq. The maximum level should be measured with the sound pressure instrument set at "Fast". Since patients have less ability to cope with stress, the LAeq level should not exceed 35 dB in most rooms in which patients are being treated or observed. Attention should be given to the sound levels in intensive care units and operating theaters. Sound inside incubators may result in health problems including sleep disturbance and may lead to hearing impairment in neonates. [8]

Table .(1): Guideline Value for Community Noise in Specific Environments

Specific environment	Critical health effect	LA eq [dB(A)]	$L_{A\ max}$ fast [dB]
Hospital, ward rooms, indoor	Sleeping disturbance night time Sleeping disturbance ,daytime and evening	30 30	40 -
Hospital ,treatment rooms ,indoor	Interference with rest and recovery	#	

#: As low as possible.

6. Measurement of Noise Levels

Noise levels were measured using the digital sound level meter (victor 824 A) which consists essentially of a microphone that converts the pattern of sound pressure fluctuations into a similar pattern of Electrical voltage, amplifiers, and a voltage meter that is normally calibrated to read in decibels as shown in **Figure (6).** For practical purposes the decibel scale ranges from 0 the threshold of hearing to about 140 dB, the onset of pain. For every increase 10 dB, there is a doubling of the sound is apparent loudness [9]. Several locations in each hospital were selected for Noise measurement, including ward corridors ward interiors,

outpatient waiting area, inside the rooms which was near the fence, near the edge of traffic. Measurement of noise level was carried on a daily basis from November to December during the days of the weak (Sunday, Monday, Tuesday, Wednesday &Thursday) in hospital A and hospital B and for hospital C.

Fig .(6) digital sound levels meters

7. Result and Analysis

Traffic volume was also taken for the intersections in the study area and near the hospitals from A.M &P.M period at the same time with noise level measurement. It was taken manually from 7:30 am to 2:30 pm in working day. HCS computer program was used to evaluate level of service for these area and this volume was so high and when the traffic performance analyzed the level of service was (F), **Figure7** show that volume for the intersection near (Al-Wasity and(Al-Elwayia) hospital and the car that are used this area was passenger car and buses . **Table (2)** shows the result of measuring noise level in three hospitals. The noise was higher in the locations for all the hospitals. And **Figure (8) (9**) show the relation between traffic volumes and noise and noise and position of measuring.

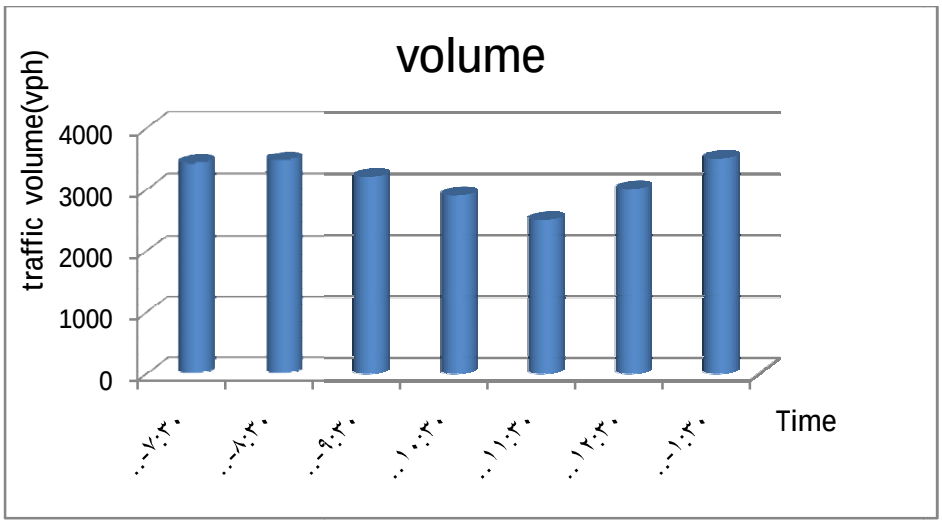

Fig .(7) Traffic Volume for Intersection in (Al-Elwayia) and (Al-Wasity) Hospital

Table .(2) Shows the Result of Measuring Noise Level in Three Hospitals

	Measurement noise at hospitals in dB		
Description	A dB	B dB	C dB
3m from traffic lane	92	92	88
Near the reception	88	86	88
Near the corridor	76	78	72
Inside the room	77	76	77
Near the fence	85	80	80

A(Al-Wasity) hospital, B (Al-Elwayia) hospital, and C (Zayed) hospital

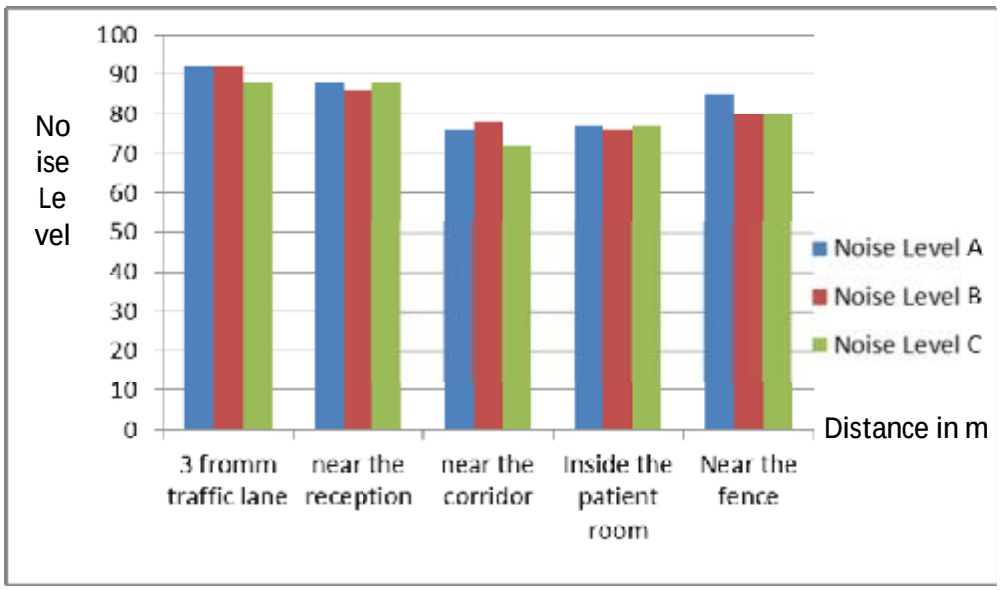

Fig .(8) Noise level for Hospitals

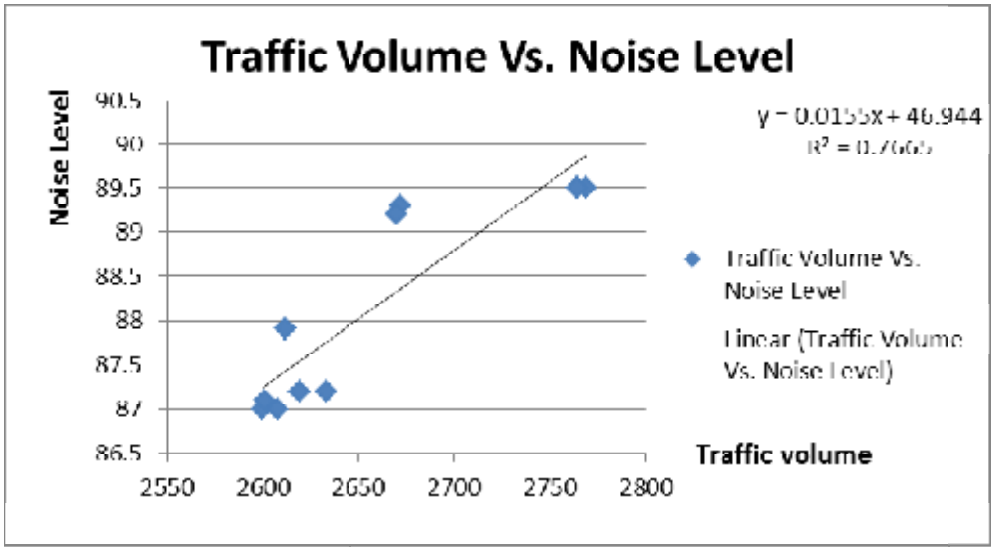

Fig .(9) relation between noise level and traffic volume

8. Conclusions

So in this study, it was found that the average sound level measured in hospitals during day time so higher than the environmental day time noise limit requirement according to Guide line as shown in **Table (1).** There are many different types of vehicles in the city which some of them are so old which is a major reason for noise pollution in the city (because the engine of old car produces more noise than the new one) also high noise levels are the result of frequent horn sound. It should promote an awareness of the population about the risks of daily exposure to high noise levels.

9. Recommendations

Architectural design can markedly reduce ambient noise levels. Traffic management measures can sometimes reduce noise problems. Traffic lights can be changed to smooth out the flow of traffic and to eliminate the need for frequent stops and starts, and also putting signs near and around the hospitals telling the drivers to reduce using horns. Noise barriers are solid obstructions built between the highway and the homes along the highway. Barriers can be formed from earth mounds along the road or from high, vertical walls. Noise barriers are designed and constructed to be visually pleasing and blend with their surroundings. This suggestion may reduce noise level.

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