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Evaluation of Traffic Noise in Certain Roads in Erbil City

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ABSTRACT

Noise is a significant environmental issue in the modern world. Traffic noise has become a serious environmental problem that plagues urban residents. Sound levels were measured using a digital sound level meter on 15 different traffics across the Erbil city during morning and night time to evaluate the traffic noise level. The results showed that the minimum sound level at morning time was 48.6 dB at site number (1) while, the maximum sound levels appeared to be 77.6 dB at site number (12) . Whereas; the minimum sound level at night time was 49.7 dB at site number (1), and the maximum sound levels appeared to be 82.1 dB at location number (12) . It was understood clearly from our study that the noise levels are elevated when compared to WHO standard level and the main sources of noise pollution are increasing number of cars and vehicles. Since the traffic noise is increasing more in Erbil city day by day so this has to be analyzed and controlled so that no health hazards pose.

Keywords:Traffic roads, Erbil city, noise level and noise pollution.

1. INTRODUCTION

Over the years, environmental noise levels have grown to such an extent that they can cause degradation of a region's noise environment and severely impact public health (de PaivaVianna *et al.*, 2015). As a dominating source of environmental noise, transportation in general and road traffic in particular, are considered to be the most significant contributor to environmental noise pollution (Hamad *et al.*, 2017). Road Traffic Noise (RTN) is the most impacting noise source of the modern lifestyle, depending upon the level of importance attached to the region or study area and is attenuated as people move away from a road (Ruiz-Padillo *et al.*, 2016; Gilani and Mir, 2021). Moreover, traffic noise pollution has become a major environmental issue that plagues urban residents and has a detrimental impact on quality of life especially for the people who operate in open-air organizations along the road or close to crowded intersections that are subjected to substantial amounts of noise pollution (Yang *et al.*, 2022; Zafar *et al.*, 2023). It diminishes comfort levels, inhibits the ability to communicate, disrupts peace, and can even cause psychological problems and cardio-cerebrovascular diseases (Van Kempen *et al.*, 2012; Halonen *et al.*, 2015). A number of studies indicates that being exposed to traffic noise in residences has been linked to a number of non-auditory health outcomes (Manuella Lech Cantuaria *et al.*, 2023) such as cardiovascular risks (Pin Wang *et al.*, 2023). Also, residents living in high-rise buildings along the main road are severely affected by traffic noise (Wu *et al.*, 2019). Numerous factors affect traffic noise level, among which traffic flow is an important influencing factor and the road network determines the distribution of traffic flow in an urban space and affects driver behaviour

(Wu *et al.*, 2008, Williams *et al.*, 2014), which further affects noise levels. As traffic noise is one of the most salient sources of discomfort associated with urban living, also it may have a direct impact on housing prices. The correlation between noise levels and housing prices has been an active subject of research over the recent years (Ozdenerol *et al.*, 2015, Guijarro 2019, Kuehnel and Moeckel 2020, Szczepanska *et al.*, 2020). So the aim of this research is to analyses the traffic noise level in Erbil city traffics, in order to figure out the quality of noises of crowded streets in Erbil and to evaluate whether the level of traffic noises reach the pollution level in comparison to standardized average.

2. MATEREAL AND METHODS

2.1. Study Area

Erbil Governorate covers an area of 15,074 square kilometers (5,820 sq mi) in the north of Iraq, with an estimated population (in 2021) of 2.25 million people according to (Kurdistan Region of Iraq " Population Analysis Report", 2021). It is located 80 kilometers (50 miles) east of Mosul in the north of Iraq, and is the capital of the Kurdistan Region of Iraq. The citadel of Erbil is considered the nucleus around which the city expanded. Erbil has the best city planning in the region, where the major streets radiate from the citadel and are intersected by three circular roads parallel to the boundaries of the citadel and to each other at different distances (Jrew *et al.*, 2017).

The study used a significant Erbil road network to measure traffic noise levels at different points along the roadside, including (Sami Abdulrahman Park, Traffic setaqan (Koya road), Iskan (60 m), Sheraton (Saidawa, Erbil), Sharh atba (Tayrawa), Tairawa (30m) Barzany namr, Traffic ankawa (60m), Franso hariri (60m), Jalil xayat (shorsh) kurdistan street, Koya Rd, Erbil (Rzgari hopital), Ankawa (abu shahab) gulan street, 120 Airport (Sarbasti, Erbil), 120 Hawlery new, Traffic cihan (Kirkuk Road, Erbil) and Traffic akar (Runaki Rd, Erbil)) as shown in figure (1).

2.2. Data collection

Digital sound level meter((14) (AR824), Measuring Range: 30 to 130dB, 35 to 130dB Accuracy: +/-1.5dB)was used in the research as shown in figure (2) which is available in the department of the Health and Environmental Science in addition to the use of special programs on smartphones for comparison andverification of readings. For each point chosen to measure the noise, several readings were recorded to obtain a realistic reading (Ali *et al.*, 2017).

2.3. Time Period

In the present study, Traffic noise data were collected at two time periods at day time peak-hour period (7:00 a.m. – 9: 00 a.m.) and night time (4:00 p.m.–6:00 p.m.). The Coordination of various selected streets as traffic noise measurement locations are presented in Table 1.

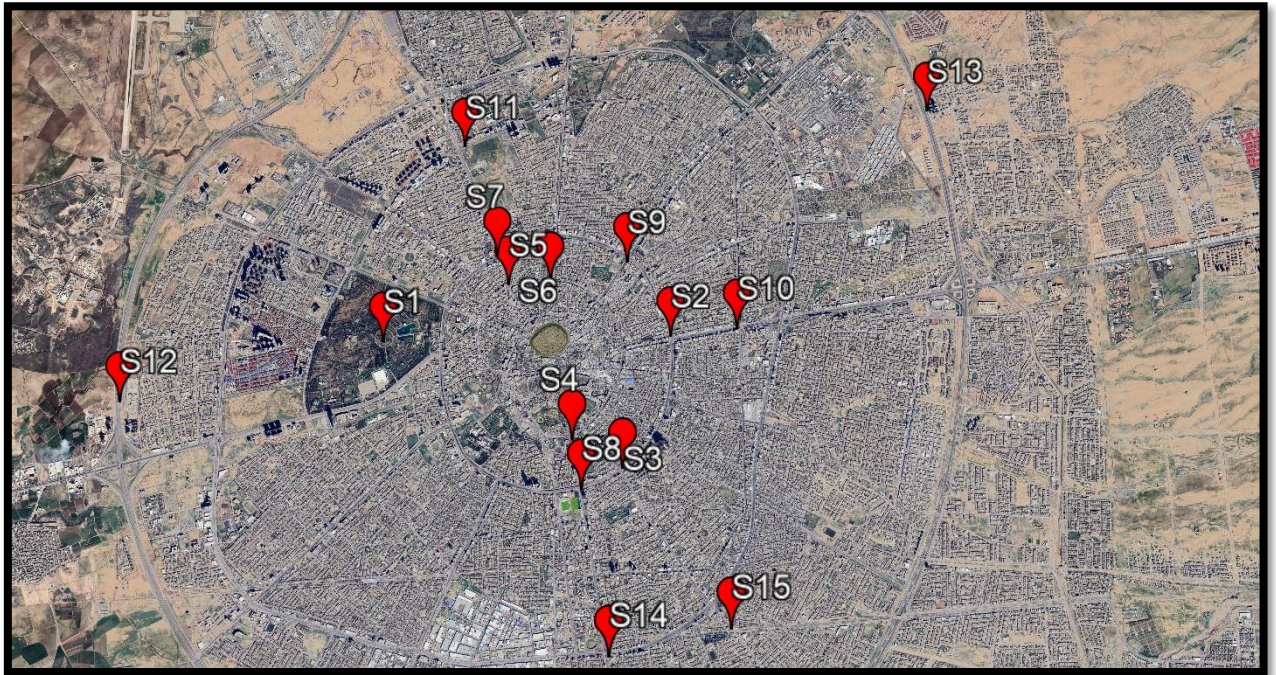


Figure 1: map showing the studied sites



Figure 2: Digital sound level meter

Table 1: Show Coordination of studied sites

Sites	Name	X	Y
1	Sami abdulrahman park	36.19128	43.9853
2	Traffic setaqan (Koya road)	36.19184	44.02629
3	Iskan (60 m)	36.17676	44.01947
4	Sheraton (Saidawa, Erbil)	36.18	44.01237
5	Sharhatba (Tayrawa)	36.19789	44.00306
6	Tairawa (30m) Barzanyamr	36.19832	44.00906
7	Traffic ankawa (60m)	36.20132	44.00139
8	Fransohariri (60m)	36.17442	44.01372
9	Jalilxayat (shorsh) kurdistan street	36.20061	44.0201
10	Koya Rd, Erbil (Rzgarihopital)	36.19273	44.03576
11	Ankawa (abushahab) gulan street	36.2145	43.99636
12	120 Airport (Sarbasti, Erbil)	36.18436	43.94825
13	120 Hawlery new	36.21867	44.06396
14	Traffic cihan (Kirkuk Road, Erbil)	36.15614	44.01763
15	Traffic akar (Runaki Rd, Erbil)	36.15918	44.03439

2.4. Statistical analysis

The obtained data was statistically analysed using statistically available software (Graph Pad Prism). One-way analysis of variance (ANOVA) was conducted to check the significance of a treatment effect followed by multiple range comparison tests of (tukey) for group comparisons. P values ≤ 0.05 were considered significant.

3. RESULT AND DISCUSSION

In this research, it was determined whether the comparable traffic noise levels at junctions in the city of Erbil was within or exceeded the local and WHO permissible levels as shown in table (3). Table 2 shows the mean day time road traffic noise levels calculated by the sound level meter for the sampling locations in Erbil city. The higher mean day time values was 77.6 dB at site (12) and the lowest value 48.6 dB was recorded at site (1). Also, there were significant differences between other studied sites for the same time period (Figure 3). However, the maximum and the minimum the mean night time noise levels observed were (82.1 dB) and (49.7 dB) noise levels at location 12 and location 1, respectively. Likewise, there were significant differences between other studied sites for the nighttime (Figure 4). Over all, the mean night time noise levels were generally higher than the mean morning noise levels. The noise level showed a significant variation at different sites which gradually increased or decreased on the basis of location of the sites. As a result, traffic noise was found to be significantly above the maximum safe limit set by the WHO for both day time and night time at each of the 15 measurement sites that were chosen as shown in table 3.

Due to the uneven distribution of noise levels across the sites under study, it was determined that these levels were most likely influenced by the amount of traffic, the type of junction, and other site factors rather than by the proximity of one site or intersection type to another as mentioned by (Abdur-Rouf and Shaaban, 2022). Also, The vehicle's type, pace, and tire friction coefficient all influence the noise level (Gilani and Mir, 2021; Abdur-Rouf *et al.*, 2022). Whereas, it is crucial to consider the length, breadth, and roughness of the road surface, as well as the building density and degree of vegetation in the surrounding region such as our studied roads differ from each other according to previous nature, as Wang *et al.* (2023) recently mentioned that traffic pollution can be amplified in various places in a high-rise, high-density cities due to the compact environment and building architecture. Additionally, the higher noise value at site 12 which located near Erbil International Airport may returned to Aircraft noise emissions. The issue of aircraft noise emissions has a detrimental impact on people's health, either directly or indirectly (Naghawi *et al.*, 2014, Akdeniz *et al.*, 2021). Whereas, Green spaces are a very important factor for noise reduction (Wickramathilaka *et al.*, 2022), this confirm our findings in site (1) during day and night time. Furthermore, our results agree with data from earlier research that studied traffic noise levels as Aziz *et al.*, (2012) resulted that mornings had greater sound levels for Erbil City, which decreased as distance increased. And when traffic was heavier and there were more heavy cars on the road, the noise level was greater, especially in the nights.

Table 2: Average Noise Level in Erbil Traffics during the Studied Period

Sites	Site name	Noise level (dB)	
		Day time	Night time
1	Sami abdulrahman park	48.60	49.75
2	Traffic setaqan (Koya road)	71.80	75.97
3	Iskan (60 m)	67.20	71.80
4	Sheraton (Saidawa, Erbil)	67.85	70.75
5	Sharh atba (Tayrawa)	65.98	71.88
6	Tairawa (30m) Barzany namr	64.53	69.43
7	Traffic ankawa (60m)	70.13	73.38
8	Franso hariri (60m)	68.83	75.25
9	Jalil xayat (shorsh) kurdistan street	72.70	76.45
10	Koya Rd, Erbil (Rzgari hopital)	69.68	75.55
11	Ankawa (abu shahab) gulan street	70.70	76.30
12	120 Airport (Sarbasti, Erbil)	77.60	82.10
13	120 Hawlery new	72.05	78.83
14	Traffic cihan (Kirkuk Road, Erbil)	71.53	74.88
15	Traffic akar (Runaki Rd, Erbil)	71.55	74.20

Table 3: Limits for Permissible Noise Exposure Proposed by WHO and Countries.

Selected noise level standards	Noise level, L_{eq} dBA	
	Daytime	Night time
WHO recommended health criteria	55	45
Germany (noise level guidelines)	45	35
Australia (recommended outdoor background noise level)	45	35
Japan (environmental quality standards)	45	35
Korea (environmental quality goal)	50	45
Philippines (environmental quality noise standards)	50	40
Malaysia (planning guidelines for environmental noise limits and control)	65	60
WHO = World Health Organization		

Source: Yuen (2014)

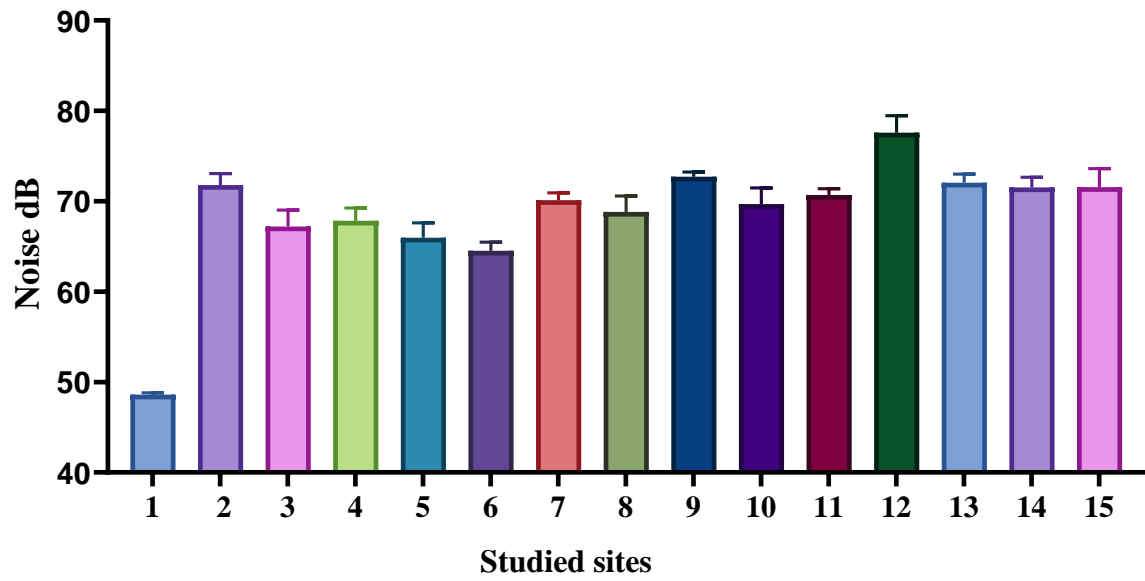


Figure 3: Showing variations in mean of noise leve measured between the study sites during day time (a.m.)

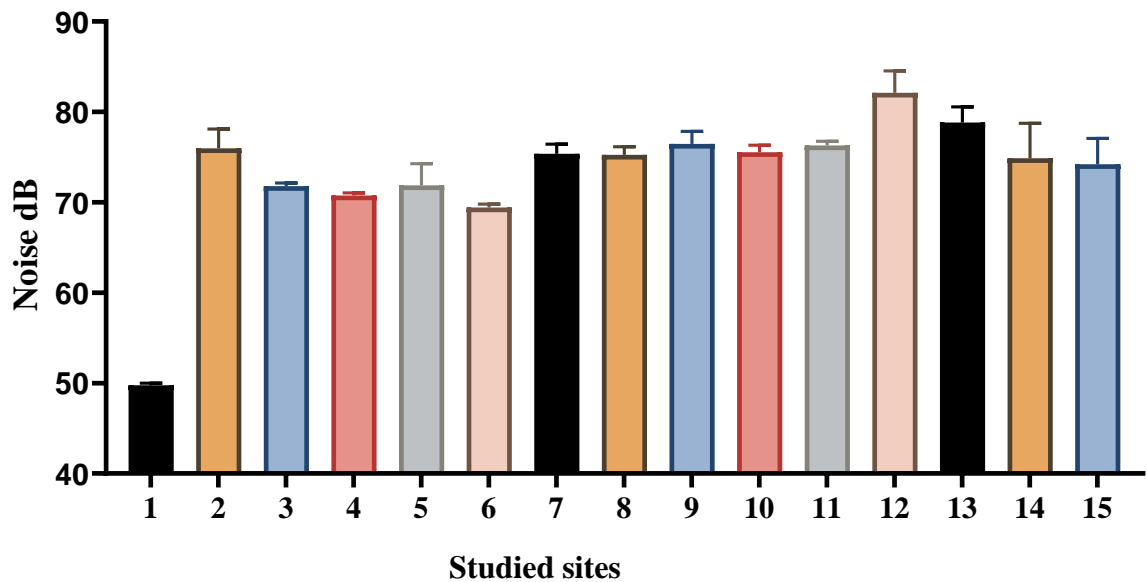


Figure 4: Showing variations in mean of noise leve measured between the study sites during night time (p.m.)

4. CONCLUSION

The current study's findings demonstrate that the city of Erbil's noise level differs at different studied locations. The measured noise levels are considerably greater than the limited noise values for the noise concerning transportation, which are between 70 dB and 60 dB. This may be due to the rapid expansion of the city and road/bridge construction has changed the spatial pattern of urban space. At the same time, the presence of the huge number of cars and vehicles which brought serious traffic noise pollution, and negatively affected the normal life for those who live near the road or bridge. The research highlights the need for setting up stringent rules around sensitive areas like hospitals, schools, residential areas, and public libraries also planting trees in order to guarantee good public health, calm environment, a better quality of life, and a healthier ecosystem.

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