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RESEARCH ARTICLE

Study of Noise Level in Different Commercial Zones of Kathmandu City and Its Effects on Human Health

***Kamana Rayamajhi*[1*], *Ritika KC*[1*]**

[1]*Department of Environmental Science, Tribhuvan University, Kathmandu Nepal*
**Email: kamanarayamajhi21@gmail.com; k.critika47@gmail.com*

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Highlights

- The study assessed ambient noise levels in major commercial zones of Kathmandu City and associated health effects on the general public
- New Road exhibited the highest equivalent noise level (79.59 dB(A)), while Thamel showed the lowest average noise level (63.93 dB(A))
- Headaches, irritation, and hearing-related problems were the commonly reported health effects among the public

Abstract

Noise refers to the presence of unwanted or excessive sound in the environment, arising from various sources such as transportation, industrial activities, commercial construction, and recreational activities. Unlike other forms of pollution that may be visible, noise pollution is invisible, making it silent yet potent threat. This study aims to determine the noise level in major commercial zones of Kathmandu City along with the health effects concerned. The study was conducted during the month of June 2025 for 12 days. The measurement of noise level was taken with the help of Sound Level Meter (SL-4010) in four different timeframes of the day i.e., 6-7 am in the early morning, 9-10 am in the morning, 1-2 pm in the afternoon, and 5-6 pm in the evening. The measurement was done for 10 minutes in the interval of 10 seconds. The study found that New Road had the highest equivalent noise level of 79.59 dB (A) whereas Thamel had the lowest average noise level of 63.93 dB (A). While assessing the health effect on the general public, major health effects were found to be headaches and irritation, hearing effects. Vehicles were the major sources of noise followed by people's crowds, commercial construction and loudspeakers.

Keywords: *commercial zones, excessive sound, equivalent, health effect, sound level meter*

Introduction

Noise is defined as the undesirable sound to human ear. The word noise is derived from the Latin Word "nausea", meaning a feeling of sickness. Noise is measured in decibels (dB) (Jariwala et al., 2017). The problem of the rise in noise pollution is faced by the major cities in the world because of the very high population, transportation congestion, and associated commercial and industrial activities (Chauhan, 2008). In recent times, noise pollution has been recognized as one of the major apprehensions that impacts the quality of life in urban zones across the globe (Hunashal & Patil, 2012). The genesis of noise pollution is inexorably tied to the rapid urbanization, industrialization, and globalization of our societies (Hemmat et al., 2023).

[*]*Corresponding author*

Noise pollution depends upon various factors such as the kind of activity involved, population density and even the local habitants and culture. Since it affects the physical and psychological behaviors of individuals, noise has become a burning issue in major cities around the world. It can lead to various health issue like nausea, vomiting, hypertension, high blood pressure, sleep disturbance, restlessness, cardiovascular problems, depression, fatigue, allergy, mental stress and annoyance (Chauhan, 2008). Compared to other types of pollution like air, water, soil and radioactive pollution, noise pollution is often given less attention in research. The main reason behind this is that the negative impacts of the other forms of pollution on human health and the environment are more noticeable and significant (Oguntunde et al., 2019). Noise pollution is increasing at an alarming rate in Kathmandu, threatening the health of the public. According to the National Sound Quality Standard of Nepal, 2012 (NSQS), the permissible noise level for commercial zone is 65dB(A) for daytime.

A study of noise levels at different rice mills of Surkhet Valley was conducted in 2021. The study found that the noise level was well above the recommended level set by the World Health Organization (WHO). It also concluded statistically that high intensity of sound causes hearing problems in workers (Paudel & Baral, 2021). A separate study focusing on Siddharthanagar Municipalitty, Rupandehi, aimed to assess noise pollution in silent, residential and commercial zones in this area. It found that maximum noise level reached 81.9 dB(A) in Bus Park of Commercial area and minimum 54.5 dB(A) at Medical College of silent zone. The study concluded that places that are along highways have high level of noise which is due to bad condition of roads, vehicles and unnecessary use of horn (Bhattarai, 2015).

Materials and Methods

Study area

Kathmandu is the capital city of Nepal. Most of the commercial hubs, educational institutions, Healthcare facilities, and industries are located here. Being the largest urban area of Nepal, many infrastructural developments, constructions, manufacturing, and vehicular movements can be detected here. Undoubtedly, Kathmandu is the busiest city in Nepal in terms of people's movement and traffic congestion.

The study was carried out in the major commercial zones of Kathmandu City. For the study purpose, six commercial zones were selected namely New Road, Asan, Thamel, Balaju, Putalisadak and Dillibazar.

Data Collection

The noise level was measured with a Portable Sound Level Meter (Model SL-4010). This device is primarily designed for community noise surveys. All noise-level measurements were taken on-site under suitable meteorological conditions with no rainfall and no winds for possible background noise error minimization. Measurements were taken during the month of June (6-21) on four different timeframes of the day. Sound levels were measured at 6-7am in the early morning, at 9-10am in the morning, at 1-2pm in the afternoon, and at 5-6pm in the evening. The measurements were taken for 10 minutes at an interval of 10 seconds which yielded 60 data in each sampling site. During the measurement, the sound level meter was held at an arm's length at a height of 1-1.5m from the ground and a distance of approximately 15m from the center of the road.

The information about the effects of Noise was gathered with the help of constructed questionnaires with relevant close-ended questions. Altogether, 120 questionnaires were taken for 120 respondents (20 from each site). 120 respondents were chosen to ensure equal representation from all six sites remaining practical in terms of time and resources, and it is sufficient to provide reliable overall result for the study.

Results and Discussion

Noise level during early morning (6am-7am)

The noise level of commercial zone was found to be highest in Asan i.e., L_{max} 84.2 dB(A) whereas it was found to be least in New Road I.e., L_{min} 55.5 dB(A). Asan is one of the busiest areas during the morning time as vendors occupy the maximum space of the street, along with that huge people's crowds contribute to rise in noise level of this area. On the other hand, during early morning few shops are open in New Road area as well as vehicles like bikes, scooter flow was less contributing to less noise in this area.

Table 1: Various Noise level indices at different sites during the early morning (6-7am)

Commercial zone	Location	Noise Level indices in dB(A)		
		L_{min}	L_{max}	L_{eq}
1	Balaju	59.65	78.45	72.95
2	Thamel	58.15	72.35	63.93
3	New Road	55.5	73.65	66.64
4	Asan	66.7	84.2	74.18
5	Putalisadak	60.15	77.2	70.22
6	Dillibazar	56.4	82.95	70.78

Similarly, the maximum L_{eq} for the early morning time was found to be highest in Asan i.e., 74.18 dB(A), and lowest in Thamel 63.93 dB(A). The graphical representation of L_{eq}, L_{max} and L_{min} values of different commercial zones is shown in Figure (1).

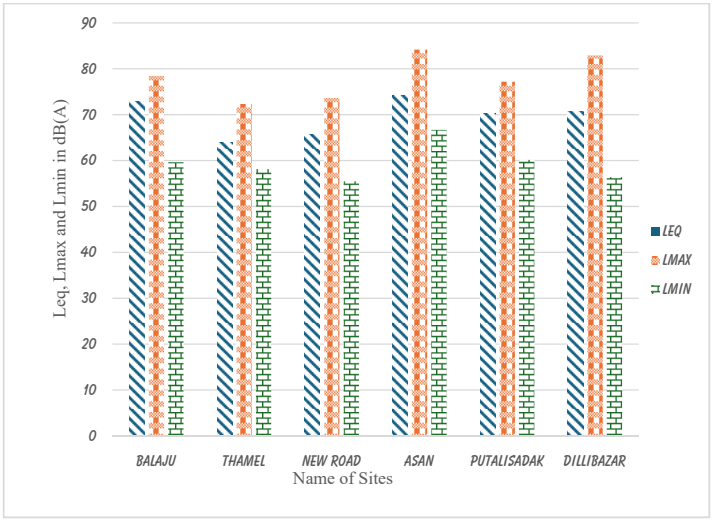

Fig .1. Leq , Lmax and Lmin values at different sites in early morning time

Noise level during morning (9am-10 am)

The noise level was found to be highest in Asan i.e., L_{max} 87.3 dB(A) whereas it was found to be least in Thamel i.e., L_{min} 53.9 dB(A). It was observed highest in Asan because of People's crowd, high number of automobiles as it is a peak hour for office time so unwanted pressure horns can be expected here. On the other hand, traffic flow is comparatively less in Thamel as public vehicles like bus and microbus do not operate here.

Table 2. Various noise level indices at different sites during the morning (9-10am)

Commercial zone	Location	Noise level indices in dB(A)		
		L_{min}	L_{max}	L_{eq}
1	Balaju	64.4	80.7	72.81
2	Thamel	58.5	74.25	65.86
3	New Road	60.6	85.55	70.8
4	Asan	58.95	87.3	74.32
5	Putalisadak	65.9	85.2	75.21
6	Dillibazar	64.65	84.35	75.23

Similarly, the maximum L_{eq} for the morning time was found to be highest in Dillibazar i.e., 75.23 dB(A), and the lowest in Thamel i.e., 58.5 dB(A). The graphical representation of L_{eq}, L_{max} and L_{min} values of different commercial zones is shown in Figure (2).

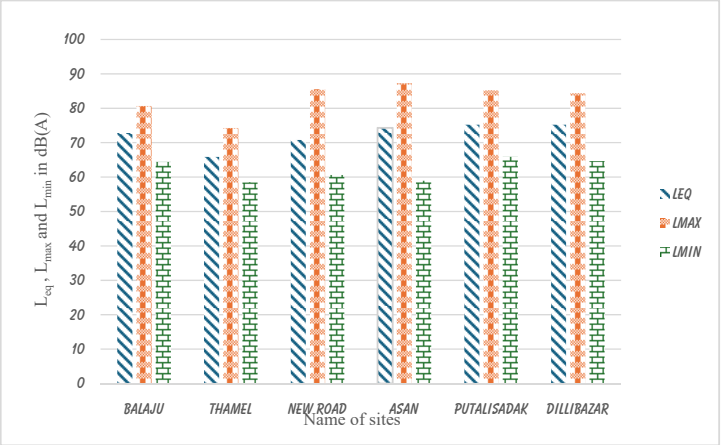

Fig. 2: Leq, Lmax and Lmin values at different sites in the morning time

Noise level during the afternoon (1pm-2pm)

Various noise level indices for afternoon time at different commercial zones of Kathmandu City are shown in Table (4). The noise level was found to be highest in Putalisadak i.e., L_{max} 92.5 dB(A) whereas it was found to be least in Thamel i.e., 51.95 dB(A). Since Putalisadak is directly exposed to heavy traffic flow and people's crowd in afternoon hour while traffic flow is comparatively less in Asan as large vehicle do not operate here.

Table 3. Various noise level at different sites in the afternoon (1-2pm)

Commercial zone	Location	Noise level indices in dB(A)		
		L_{min}	L_{max}	L_{eq}
1	Balaju	61.55	86.3	73.31
2	Thamel	51.95	77.85	65.72
3	New Road	64.1	86.5	74.36
4	Asan	58.15	86.05	75.21
5	Putalisadak	64.4	92.5	77.53
6	Dillibazar	59.4	83.3	72.69

Similarly, the maximum L_{eq} for the afternoon time was found to be highest in Putalisadak i.e., 77.53 dB(A) and lowest in Thamel 65.72 dB(A). The graphical representation of L_{eq} ,L_{max} and L_{min} values of different commercial zones is shown in Figure (3).

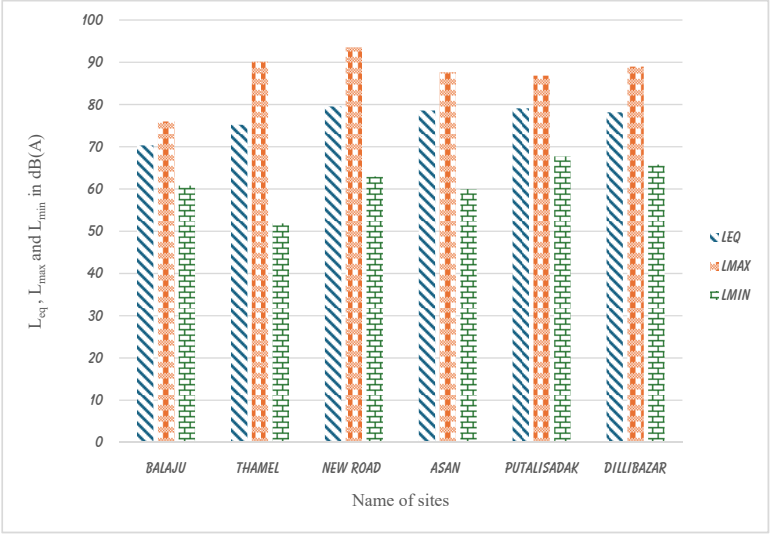

Fig. 3. Leq , Lmax and Lmin values at different sites in afternoon time

Noise level during the evening time (5pm-6pm)

The noise level was found to be highest in New Road i.e., 93.55 dB(A) whereas it was found least in Thamel i.e., 51.9 dB(A). New Road has the highest noise level because at this hour people's crowd for shopping increases significantly while traffic flow was relatively decreased during this hour in Thamel. Similarly, in Ahvaz city of Iran maximum sound level was observed to be 95.46 dB (A) and the minimum sound level as 57.25 dB (A) (Geravandi et al., 2015).

Table 4: Various noise level indices at different sites in the evening (5-6pm)

Commercial zone	Location	Noise level indices in dB(A)		
		L_{min}	L_{max}	L_{eq}
1	Balaju	60.85	76	70.35
2	Thamel	51.9	90.15	75.23
3	New Road	63	93.55	79.59
4	Asan	60	87.7	78.61
5	Putalisadak	67.75	86.85	79.09
6	Dillibazar	65.8	89	78.17

Similarly, the maximum L_{eq} for the evening time was found to be highest in New Road i.e., 79.59 dB(A) and lowest in Balaju 70.35 dB(A). The graphical representation of L_{eq} ,L_{max} and L_{min} values of different commercial zones is shown in Figure (4).

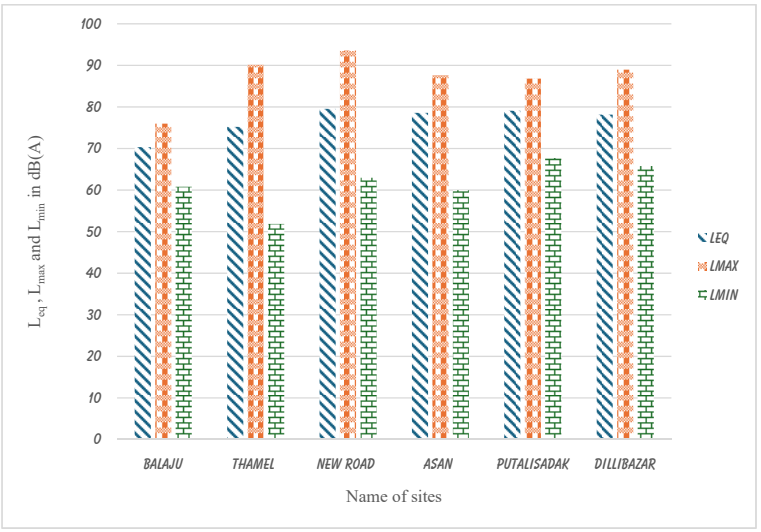

Fig. 4. Leq ,Lmax and Lmin values at different sites in the evening time

Comparison of noise levels of the Nepal Ambient Sound Quality Standard (NASQS) and WHO

According to the Nepal Ambient Sound Quality Standard (NASQS), 2012, the standard noise level in commercial zones during the daytime (6am to 9 pm) is not more than 65 dB(A). Based on this study, noise levels in commercial zones vary from 63.93 dB(A) to 79.59 dB(A), which shows that the noise level in almost every commercial zone exceeds the standard level set by NASQS. Noise levels more than 65 dB(A) in commercial zones have adverse impacts on human health. Therefore, chronic exposure to these zones can lead to various health issues in human beings such as annoyance, irritation, hearing problems, hypertension, headache, stress, etc.

According to WHO, the standard noise level in commercial zones is not more than 70 dB(A). The finding shows that all the commercial zones (except Thamel) exceed the standard value set by WHO. The Commercial area had experienced a heavy crowd of people as well as more engagement of automobiles (Chauhan et al., 2021).

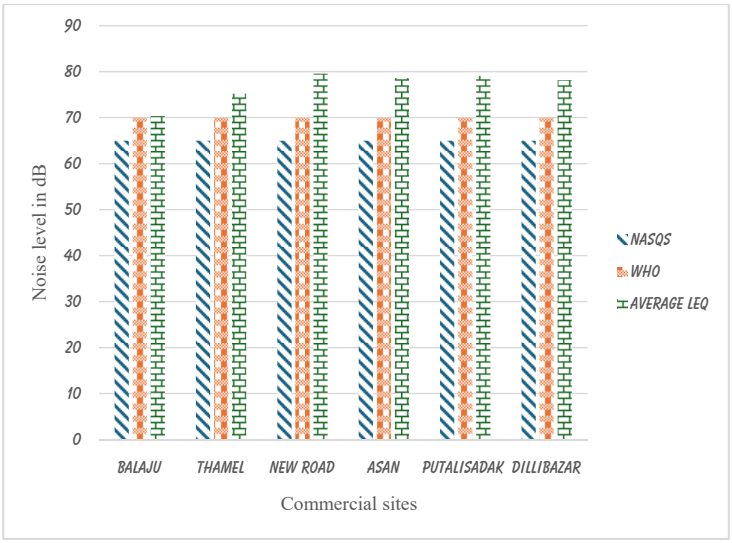

Fig. 5. Comparison of Leq of commercial zones with NASQS and WHO

Results and Discussion from Questionnaires

Time of maximum noise

Respondents were exposed to maximum noise during different times of the day, and the distribution is shown in Figure 7. More than half of the respondents (54%) said that they were exposed to maximum noise in the evening time, 26% of respondents were exposed to maximum noise in the afternoon time, and only 20% of them were exposed to the maximum noise in the morning time.

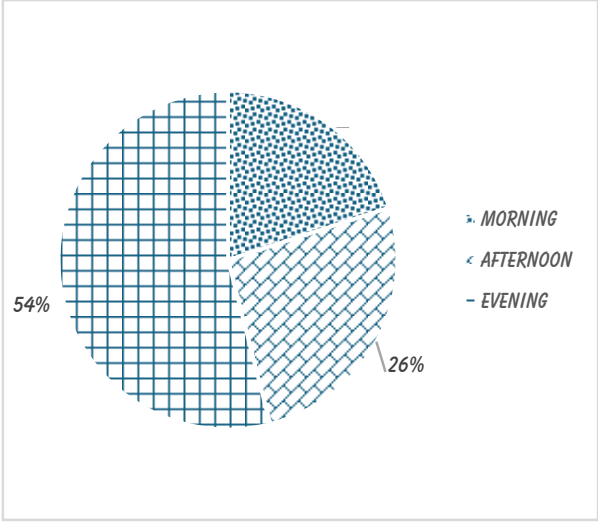

Fig. 7. Time of maximum noise

Major source of noise

From this study, it was found that respondents were exposed to noise from different sources which is presented in Figure 12. 51% of the total respondents felt that vehicles are the major sources of noise. 35% of the respondents said that people's crowds are the major source of noise they are exposed to. 8% of respondents are mainly exposed to commercial construction and lastly, 6% say others which include loudspeakers.

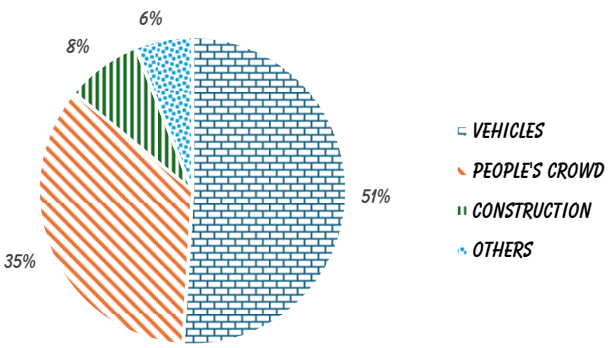

Fig 8: Major sources of noise

General disturbances due to noise

Noise has direct effects on human beings which include health effects as well as effects on their day-to-day lives. Hearing issue is the major disturbance caused by noise as 31% of respondents said this. 27% of respondents said that their overall work efficiency is reduced due to noise. Similarly, 23% of the respondents explained that they had to face disturbance in communication due to noise. Lastly, 19% respondents said that they are unable to concentrate on their work because of the noise. Due to these disturbances, the shopkeepers and businessmen are facing difficulties communicating with their customers.

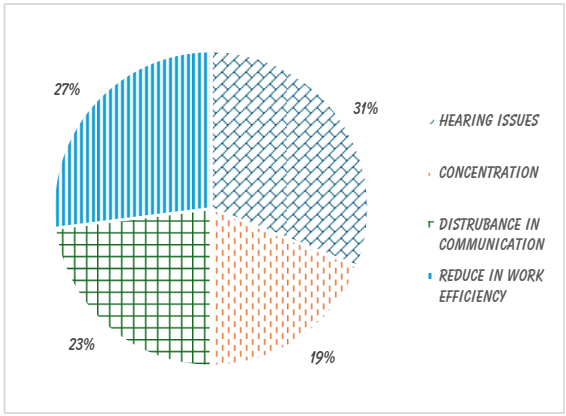

Fig. 9. General disturbances due to noise

Major health effects

As per our study, noise has numerous health effects on human beings as a very large proportion of people responded that their health is affected in some way due to excessive noise. 43% of the respondents complained that they have irritation and headaches due to high noise. The number of respondents who had stress and anxiety was comparatively lower i.e., 14%.Remaining had hearing effects and stress or anxiety with 23% and 14% respectively. Our study showed that this effect is more common in elderly age group in comparison to young ones.

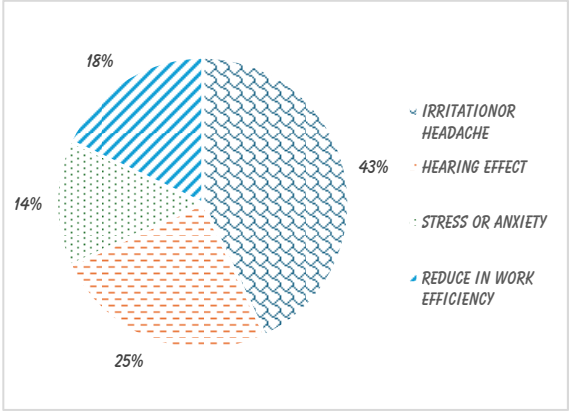

Fig .10. Major health effect of noise

Control measures

For the control measure to reduce noise pollution majority of respondent said Traffic management should be done (52.5%). Along with this 24.1% said strict laws should be made, which is followed by installation of Noise barrier (17.5%). Remaining respondents suggest that vehicles should be allowed to drive on an odd and even number basis, some said commercial areas with heavy traffic should have no horn zone and rather than using own private vehicles we should establish the habit of travelling in public vehicles.

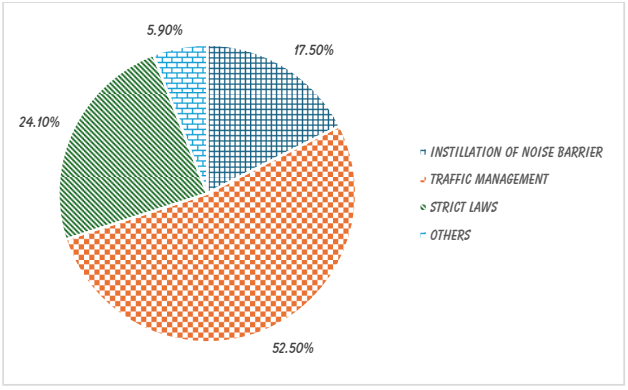

Fig. 11. Control measures of noise

Conclusions

This study aimed at determining the noise level and its possible health effects in different commercial zones in Kathmandu City. To sum up the findings of this study, New Road is the busiest and noisiest place with L_{eq} 79.59 dB(A), whereas Thamel has the least noise with sound level of 63.93 dB(A). According to NASQS, the standard noise for daytime in commercial zones is 65 dB(A). Based on our findings, except Thamel all other selected sites exceed the standard noise level set by NASQS which is concerning as it determines human health and overall wellbeing. While comparing the noise with WHO standard, only Thamel (63.93 dB(A) falls under the recommended value that's not more than 70 dB(A).

Furthermore, based on the questionnaire survey conducted among 120 respondents, almost all kinds of respondents had some kind of health issues due to excessive noise. The major health issues faced by people are irritation and headache, hearing effects. Additionally, there are exposed to further disturbances like reducing concentration, reduction in work efficiency, and difficulty in communication. Vehicles are the major sources of noise in these areas, followed by people's crowds, construction and loudspeakers. Therefore, special measures are required to be adopted to reduce the level of noise pollution and its adverse impact on our environment. By recognizing and mitigating the health risks associated with noise, we can create healthier and more livable environments for everyone.

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