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Assessing Noise Level near Educational Institutions of Dhangadhi Sub-Metropolitan City

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Abstract

Noise pollution is one of the major environmental threats that highly affects human livelihood. This study aims to assess the noise level near educational institutions located in Dhangadhi Sub-Metropolitan City. Eighteen schools were chosen for this study. The noise level was recorded in those schools in the school time (10:00-16:00). For measurement, time was categorized into three parts viz. 10:00-12:00; 12:00-14:00; and 14:00-16:00. The noise level was measured using a digital sound level meter in the month of February 2024. The result shows that the noise level (L_{eq}) measured at different locations is above the prescribed standard value of noise level. Among the selected institutions, the noise level was higher in those schools which are near the roads. The institutions that are little inside the road are less noisy. This study reveals that the noise pollution in the respective institutions is due to high traffic of vehicles, bad condition of road, human crowd, unnecessary use of horns, etc.

Keywords: Noise pollution, environmental pollution, traffic, human crowd

Introduction

Noise is considered as the undesirable and unwanted entity for human beings. Pollution because of abundant amount of noise is called noise pollution. A major cause behind noise pollution is due to the increase of population, industrialization and other technological advancements like speakers, sound boxes, etc. From road to home, there are many sources which produce a lot of sound leading to noise pollution. In contrast to other forms of pollution, noise pollution is a little bit different and least understood. However, its harmful effects can easily be observed. It

causes several side effects like decrease in efficiency, increase in blood pressure and other health related issues (Bhattarai, 2014). Noise is a common problem faced by many people in the world. With the increase in motor traffic, the noise level also goes on increasing (Baltrenas et al., 2010).

Noise pollution deteriorates the quality of life especially in urban areas across the world. Throughout the globe, urbanization is at the apex causing rapid road traffic, construction of roads and infrastructures which results the noise pollution. Among various forms of noise pollution, traffic pollution results due to continuous flow of vehicles, poor maintenance of the vehicles and unnecessary blowing of the horns (Singh et al., 2022).

A sound wave is a form of wave moving in air or in other media that causes hearing sensation. Noise is simply defined as unwanted sound which may be due to different natural and artificial means. According to World Health Organization (WHO), noise pollution falls in second rank among different environmental pollution (Chhetri et al., 2019). Rapid urbanization and industrialization are the significant causes of noise pollution. Noise pollution causes severe effect on human beings. WHO also highlighted noise pollution as one of the major environmental pollution. Apart from several other causes, noise coming from road traffic highly affects the quality of life especially in urban areas. Noise pollution causes several side effects like annoyance, sleep disturbance, hormonal disorder, hypertension and psychiatric disorder (Mishra et al., 2021).

High noise level in the background may cause side effects on auditory and nervous system (Chauhan et al., 2010). In the urban areas, traffic due to vehicles is the major source of noise pollution (Bhosale, 2010; Mavrin et al., 2018). Due to high population rise and several industrial activities, cities and towns are facing the big problem in the form of noise pollution (Datta et al., 2006). The noise pollution can cause several problems in human health like noise induced hearing impairment, disturbance of sleep and other mental side effects. High noise in the festival time is also being one of the sources of annoyance (Goswami et al., 2013).

Noise pollution has severe effect on physical and psychological aspects of human health. Noise also affects nervous and endocrine system. Aircrafts, vehicles and other transportation system are the major sources of noise pollution in urban cities (Geravandi et al., 2015). Due to the continuous exposure to high noise, the workers in the factory are suffering from various health effects. Directly or indirectly, noise pollution causes the adverse effects that impair the human health. Apart from human health, noise pollution possesses adverse effects on the resident, society and environment. Exposure to high level of noise increases the stress on human being which leads to increase in antisocial activity in them (Jariwala et al., 2017).

This study tries to explore the level of noise near educational institutions located in Dhangadhi Sub-Metropolitan City. This study shows the present status of noise in those areas and some recommendations to reduce noise pollution. This study deals with a basic research question: What is the current noise level near the educational institutions of Dhangadhi Sub-Metropolitan City?

Literature Review

There have been various studies in the past carried out to assess or measure the noise level in different locations. In national and international level, there has been a number of studies that explored the noise level. In this regard, Bhattarai (2014) has done a survey to measure the sound level at various places of Siddharthanagar Municipality by categorising selected locations into three zones viz. silent, residential and commercial zones. He used Dick Smith Digital Sound Level Meter Q 1362 to measure the sound level. He concluded that average noise level at all the selected regions was more than that prescribed by Government of Nepal and WHO. Furthermore, he mentioned the heavy noise pollution near road side area is due to bad condition of roads, vehicles and unnecessary use of horns.

Likewise, Whittaker et al. (2014) carried out a study to assess noise-induced hearing loss in small scale metal industry in Nepal. They took 115 metal workers and 123 hotel workers (control group) for the study. They found that noise induced hearing was 30.4 percent in metal workers and 4.1 percent in the hotel workers. They found that in the workplace, the noise level was 65.3-84.7 dB in metal workers sites and in hotel workers (control site) the noise level was 51.4-68.6 dB. They concluded that metal workers have greater possibility for the noise-induced hearing loss.

Singh et al. (2022) carried out a study to assess a traffic noise along the ring road side of Kathmandu Valley, Nepal. They recorded noise level data using sound-level meters. At all the junction points they had selected, Leq exceeded 70 dB which is more than the standard national and international noise level. They mentioned that if population rises in the same fashion, it may cause many adverse health effects in human beings.

Another study conducted by Chhetri et al. (2019) aimed to evaluate traffic noise levels in Kathmandu valley. They recorded intensities of noise level at 31 different places of Kathmandu valley. They have mentioned Satdobato and Putalisadak as a highly polluted area exceeding noise level beyond 80 dB. They concluded that in Kathmandu valley, the noise level was about 72 dB. They also recommended that policy need to be implemented perfectly and it is also needed to spread the awareness of adverse effects of noise pollution.

Likewise, Mishra et al. (2021) made a study to assess the effect of COVID-19 lockdown on noise pollution level of Lucknow city of India. They investigated the change in noise level at different areas of Lucknow city viz. residential, commercial, industrial and silent zones. They have compared and analysed the level of noise before, during and after the lockdown at the selected places. They have used portable environmental sensors to collect the data. They found that average noise levels before lockdown were 44.85 dB to 79.57 dB whereas the average noise levels after the lockdown found as 38.55 dB to 57.79 dB. They found significant decrease in the sound level during the lockdown time as compared to that of pre and post lockdown period. Their study observed significant decrease in annoyance and sleep disturbance level during lockdown period than pre- and post-lockdown period. They suggest to implementing strict noise control policies to reduce the adverse effects caused due to noise pollution.

Another study by Chauhan et al. (2021) assessed noise pollution level in Kathmandu valley and also investigated the effectiveness of implementation of noise standard. They concluded that there is significant amount of noise pollution and no horn regulation were not followed strictly. They recorded average noise level as 66.8 dB in Kathmandu valley. They mentioned that in about 65.2% of sample locations, the noise level was more than standard noise level. Likewise, Baltrenas et al. (2010) assessed noise level in the southern part of Panevezys. They took measurement during three periods of the day; daytime (6 a.m. to 6 p.m.), evening (6 p.m. to 10 p.m.) and at night (10 p.m. to 6 a.m.). They mentioned that noise generated by the car is the major source of noise pollution.

Chauhan et al. (2010) also mentioned that electricity generators and transportation are the major sources of noise pollution in Moradabad city of India. They found the noise level was above the prescribed standard noise level. They recommended that proper maintenance of vehicles and roads, planation of the trees may help in reducing the noise level. They also highlighted that awareness about the effects of noise pollution may help in controlling the noise pollution.

Bhosale et al. (2010) measured the traffic noise level in the Aurangabad city of India. They found maximum and minimum noise level in working day were 84 dB and 74 dB whereas in holidays maximum and minimum noise levels were 81 dB and 70 dB. They also pointed that as like other forms of pollution, noise pollution is also one of the emerging environmental pollution. Especially for the people of urban areas noise pollution is the subject of concern. Likewise, Datta et al. (2006) assessed the noise level in Burdwan town of West Bengal India using the sound level meter. They found noise level in the range of 64-85 dB. They also mentioned adverse effect of noise on human health. They pointed that different pathological and psychological

disorder can occur in human health because of noise pollution. They also argued the necessity of public awareness among the people to control the noise pollution.

Stansfeld and Matheson (2003) discussed about the effects of noise pollution on human health. Noise pollution causes sleep disturbance, modifies social behaviour, cause annoyance, hypertension and etc. Aircraft and traffic noise exposure causes psychological symptoms. Especially in children, aircraft noise may cause impairment in reading comprehension and long-term memory. Along with this, Singh and Davar (2004) performed a cross sectional survey in the Delhi state. They pointed that loudspeakers and automobiles were the major sources of noise pollution. Noise pollution effects are interference with communication, sleeplessness, and reduction in efficiency. Apart from this, noise pollution may cause extreme level of deafness and mental breakdown. They recommended reducing or stopping the noise produced in the party to control the noise pollution. Regardless of administrative kind of punishment to the people, the public awareness and public education about the noise pollution may help in reducing noise pollution.

Geravandi et al. (2015) conducted a study to evaluate the effect of noise pollution on human health. From the cross-sectional study, they found that equivalent sound level in all station were 76.28±3.12 dB. They concluded that, to compensate the noise from road traffic, proper planning is necessary to prevent noise pollution and become safe from its effects.

Munzel et al. (2021) mentioned that with the increase in noise pollution there is high risk of happening heart related disease. The traffic noise disturbs the sleep, elevates the stress hormone levels. Noise-induced stress may deteriorate the learning and memory of the children when exposed to aircraft noise. Juang et al. (2010) conducted a study to assess the effect of noise pollution on medical care workers and patients in some hospitals of Taiwan. They found that daily average sound levels inside the hospitals in day time were between 52.6 dB and 64.6 dB. This noise level was more than standard noise level (50 dB) of Taiwan.

The literature discussed above implies that noise pollution is one of the major issues of the modern urban society. In the context of Nepal too, the urbanization is rapidly growing. Above discussion also shows, in Nepali cities, there is high level of noise pollution. This study mainly focuses to assess the noise level in Dhangadhi Sub-Metropolitan City, Kailali, Nepal.

Methods and Procedures

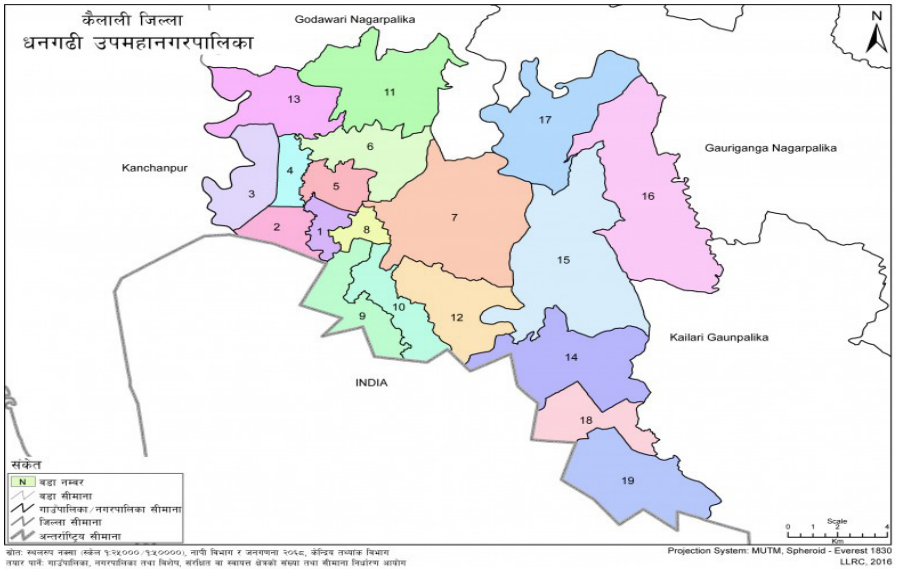
Study Area

Dhangadhi Sub-Metropolitan City is located in Kailali district of the Far

Western Province of Nepal. It is the district headquarters of Kailali. Dhangadhi is one of the major cities of the whole Far Western region. It is the centre of education, health, industries and commerce of this province. Dhangadhi Airport, a national airport, also lies in this Sub-Metropolitan City. Moreover, this Sub-Metropolitan City is adjacent to India-Nepal border. This is one of the gateways for entering into Nepal from India. It is located about 109 meters above the sea level and is about 750 km west from capital city Kathmandu. This Sub-Metropolitan City lies in plane region covering an area of about 271.74 sq. km.

Figure 1

Geographical Map of Dhangadhi Sub-Metropolitan City



Data Collection

This study is field based. For this study, we have chosen eighteen locations. The selected sites are near the educational institutions of Dhangadhi Sub-Metropolitan City. We have selected eighteen educational institutions namely; Aishwarya Vidya Niketan (AVN), Galaxy Secondary School, Kantipur Technical College, Panchodaya Secondary School, Axis Vidyashram, Balmiki, Jay Malika College, Hill World School, Jaycess English Secondary School, Steeping Stone English Boarding School, Himal Secondary School, Saradha Secondary School, SPA Academy, Aristo English Boarding School, Three Star Secondary School, Apee Academy, Kailali Vidya Niketan and Kailali Multiple Campus (KMC).

The noise level was measured using a portable digital sound level meter. The

sound level meter has the range of 30-130 dB having an accuracy of 1.5 dB. The measurements were carried out in the day time from 10:00 to 16:00 in the month of February 2024. We categorized this time into three parts 10:00-12:00, 12:00-14:00, and 14:00-16:00. At each location the reading was recorded thrice a day as the above mentioned time range. All the readings were measured under normal atmospheric condition. The data recorded from the field are then refined and tabulated. For the analysis of the data, different bar diagrams are plotted which makes visualization clear and meaningful.

Features of Digital Sound Level Meter

Measuring range: 30~130 dBA

Accuracy: ±1.5dB

Frequency Response: 31.5Hz ~ 8 KHz

Resolution: 0.1dB

Working Temperature and Humidity: 10~ 60^0 C, 0~90 % RH

Power source: 3* 1.5V AAA Batteries

Weight: 84.08g (excluding battery)

Sound Intensity Level

The rate of flow of sound energy through an area is the intensity of sound wave. The intensity level of sound is defined as $\beta = 10\log_{10}\left(\frac{I}{I_0}\right)$

Where, I represents the intensity of sound and I_0 represents threshold of hearing, $I_0 = 10^{-12} Wm^{-2}$.

Results and Discussion

The data recorded from the field are arranged in tabulated form as shown below.

Table 1

Noise Level in dB at near Different Educational Institutions of Dhangadhi Sub-Metropolitan City

S.N	Name of place	Latitude	Longitude	10:00 - 12:00			12:00 - 14:00			14:00 - 16:00		
				Leq	Lmax	Lmin	Leq	Lmax	Lmin	Leq	Lmax	Lmin
1	A.V.N	28 42' N	80 35' E	71.47	74.16	58.35	62.88	72.54	56.63	57.49	67.07	55.76

2	Galaxy	28 42' N	80 35' E	68.5	77.76	60.6	67.61	73.5	60.64	62.75	70.43	54.58
3	Kantipur	28 42' N	80 35' E	57.07	63.15	48.32	51.65	57.32	42.74	49.41	57.52	43.7
4	Panchadaya	28 42' N	80 35' E	59.01	63.25	47.26	52.99	60.66	48.76	45.64	51.35	39.1
5	Axis	28 42' N	80 35' E	67.11	70.61	55.5	67.15	68.91	55.5	65.75	70.2	58.35
6	Balmiki	28 42' N	80 35' E	66.88	72.96	57.01	70.39	74.06	58.5	67.81	73.46	57.84
7	Jaya malika	28 42' N	80 35' E	62.02	63.9	48.18	61.34	58.18	45.34	61.79	62.51	50.9
8	Hill world	28 42' N	80 35' E	67.21	69.35	53.48	63.15	67.77	62.45	62.25	59.39	47.88
9	Jaycees E.S	28 42' N	80 34' E	62.15	67.18	53.95	64.36	62.81	49.53	57.69	61.43	48.92
10	Steeping	28 42' N	80 34' E	61.17	58.63	49.49	60.45	63.18	48.13	54.35	60.6	49.95
11	Himal school	28 42' N	80 34' E	61.08	67.97	52.18	62.07	63.53	51.65	63.95	65.39	52.31
12	Saradha	28 42' N	80 34' E	63.67	67.23	55.66	63.74	69.8	56.56	66.93	68.42	57.43
13	S.P.A	28 42' N	80 34' E	60.71	64.25	51.31	57.66	62.56	45.4	63.06	66.87	54.66
14	Aristo.E.S	28 42' N	80 36' E	65.26	69.64	57.71	65.19	69.37	57.99	67	72.11	59.11
15	Three Star S	28 42' N	80 36' E	61.9	67.34	56.27	67.63	71.08	61.7	60.6	70.8	53.77
16	Apee academy	28 42' N	80 36' E	56.24	64.62	49.15	59.12	67.37	46.84	59.84	67.5	46.12
17	Kailali V.N	28 42' N	80 36' E	53.94	59.94	39.39	52.71	64.52	40.08	58.75	65.21	42.39
18	K.M.C	28 42' N	80 36' E	49.08	61.11	42.18	57.48	58.97	44.93	58.13	66.76	45.45

Table 2

Noise Level Standard of Nepal (Bhattarai, 2014)

S.N.	Area	Noise level in dB (Day time)	Noise level in dB (Night time)
1	Silent Zone	50	40
2	Business Area	65	55
3	Urban Residential Area	55	45

WHO also indicates safe noise level for urban area as 45 dB. Table 2 shows the standard noise level of Nepal (Bhattarai, 2014).

Table 1 shows the noise level indices near various schools of Dhangadhi Sub-Metropolitan city. The results show that noise level at all locations is greater than the noise level as prescribed by government of Nepal and WHO. The maximum Leq 71.47 dB was observed near A.V.N school in the time zone of 10:00 – 12:00. However minimum noise level of Leq 45.64 dB was observed at Panchodaya Secondary School in the time zone of 14:00- 16:00. Table 1 also shows that the value of Leq in selected locations is around 60 dB which above the standard value of noise.

Figure 2

Representation of Noise level (Leq) in dB at various locations at time 10:00 – 12:00

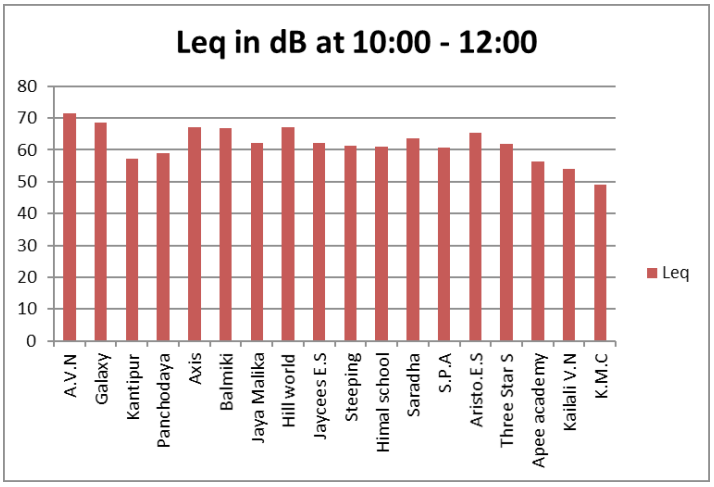


Figure 2 shows the noise level at various locations (Educational institutions) of Dhangadhi Sub-Metropolitan City at time between 10:00 – 12:00. Above figure shows that noise level is maximum (71.47 dB) near A.V.N. school Dhanagdhi. It is because of high traffic in the road and high crowd as this school is close to crowded road. Comparatively low noise level (51.65 dB) was found at Kantipur Technical College because it lies at low crowd region and also it lies little inside highway. This figure shows that in majority (around 72% of the total schools) noise level was beyond 60 dB in the time range of 10:00 – 12:00.

Figure 3

Representation of Noise level (Leq) in dB at Various Locations at Time 12:00 – 14:00

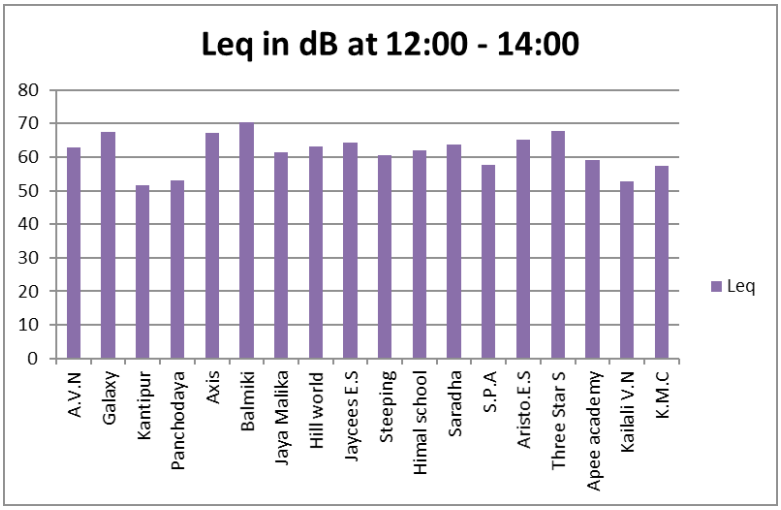


Figure 3 shows that the noise level is maximum (70.39 dB) at Balmiki school. This is because of high traffic in the road and bad condition of the road. Along with this, as the construction is going in the road, the chance of noise pollution is high. Likewise, the low noise level (51.65 dB) was observed in Kantipur Technical college which is because this college lies in low crowd area where road traffic is also low. In majority of the places, the noise level was greater than 60 dB. About 66% of the total schools have noise level higher than 60 dB.

Figure 4

Representation of Noise Level (Leq) in dB at Various Locations at Time 14:00 – 16:00

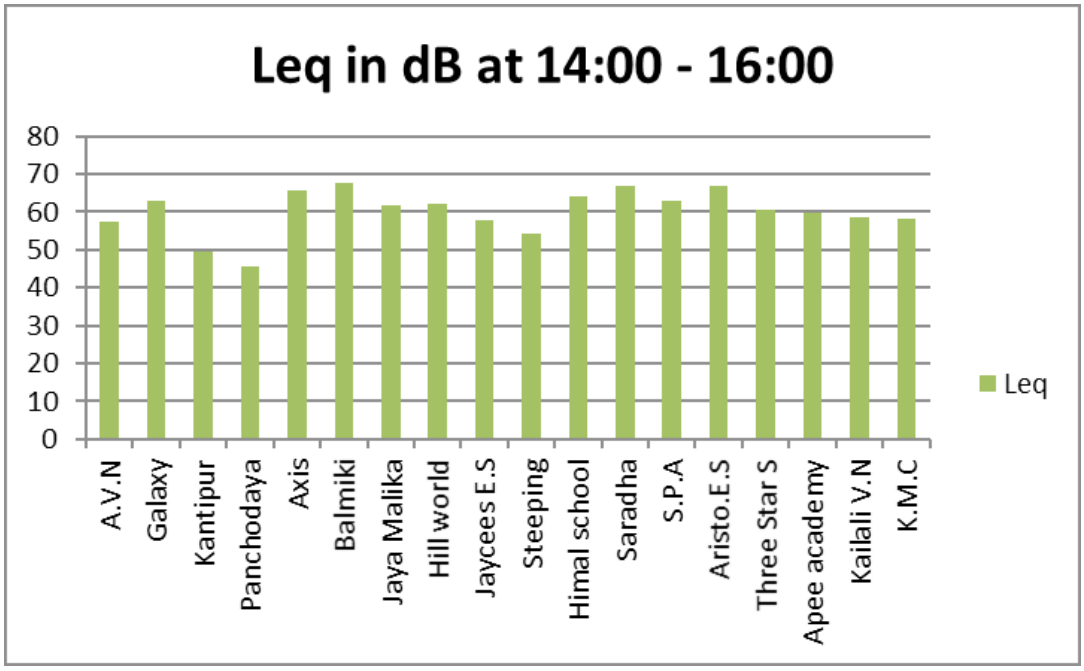


Figure 4 shows the noise level variation near different schools at time 14:00 – 16:00. In this time range too, the noise level was maximum (67.81 dB) near Balmiki school. The high noise level was due to high road traffic and bad condition of the road. Whereas, noise level was least (45.64 dB) near Panchodaya School which is because the school lies little inside the highway. Again in this time range too, the noise level in those schools was more than 60 dB. In this time range, the noise level was found as little less than that of 10:00- 14:00 range.

Figure 5

Representation of Variation of Lmax and Lmin in dB at Various Locations at Time 10:00 – 12:00

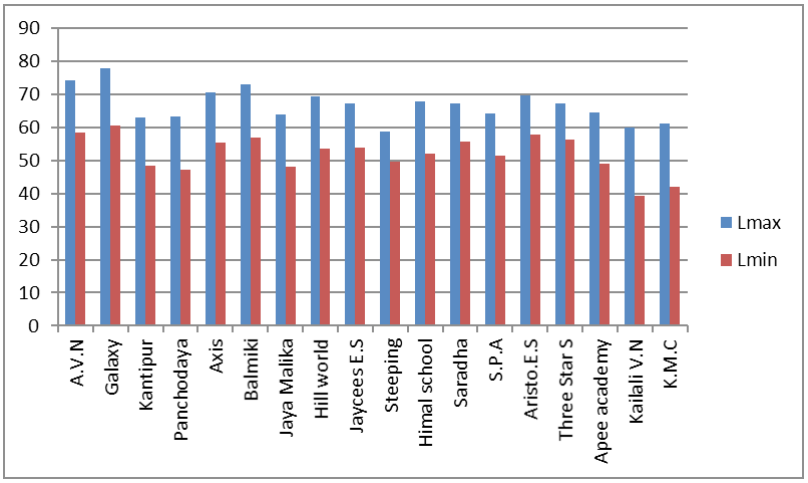


Figure 5 shows the comparison of Lmax and Lmin in the time range 10:00 – 12:00. In this time range Lmax has maximum value of 77.76 dB at Galaxy School whereas Lmin has minimum value of 39.39 dB at Kailali V.N. In majority of the schools Lmax has the noise level greater than 60 dB.

Figure 6

Representation of Variation of Lmax and Lmin in dB at Various Locations at Time 12:00 – 14:00

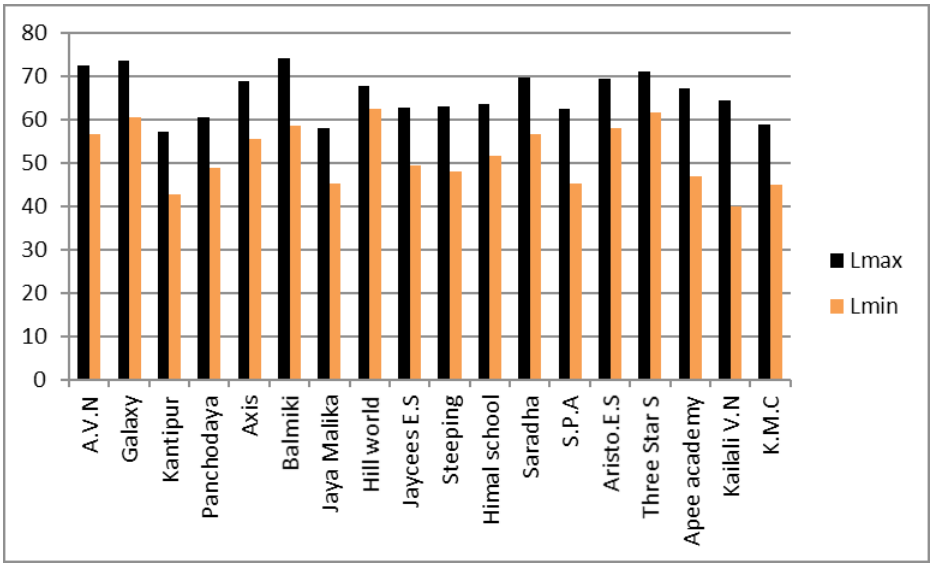


Figure 6 shows the comparison of Lmax and Lmin in the time range 12:00 – 14:00. In this time range Lmax has maximum value of 74.06 dB at Balmiki School whereas the Lmin has minimum value of 40.08 dB at Kailali V.N. In majority of the schools Lmax has the noise level greater than 60 dB.

Figure 7

Representation of Variation of Lmax and Lmin in dB of Various Locations at Time 14:00 – 16:00

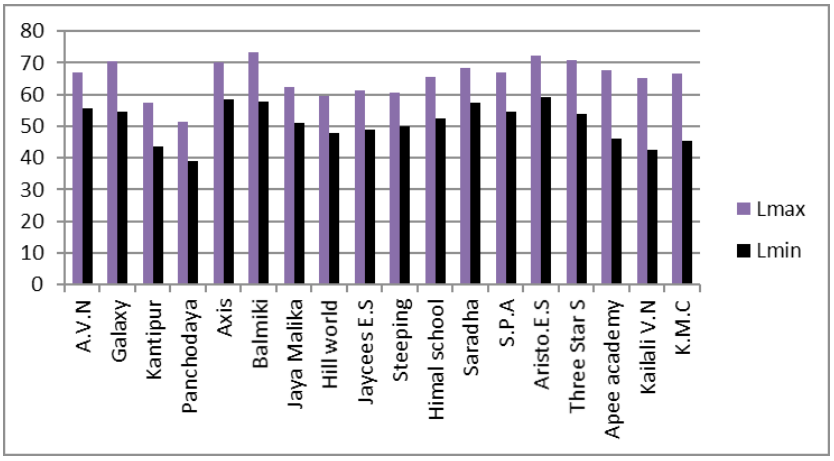


Figure 7 shows the comparison of Lmax and Lmin in the time range 14:00 – 16:00. In this time range Lmax has maximum value of 73.46 dB at Balmiki School whereas the Lmin has minimum value of 39.10 dB at Panchodaya school. In majority of the schools Lmax has the noise level greater than 60 dB.

Figure 8

Representation of Average of Leq in dB at Various Locations

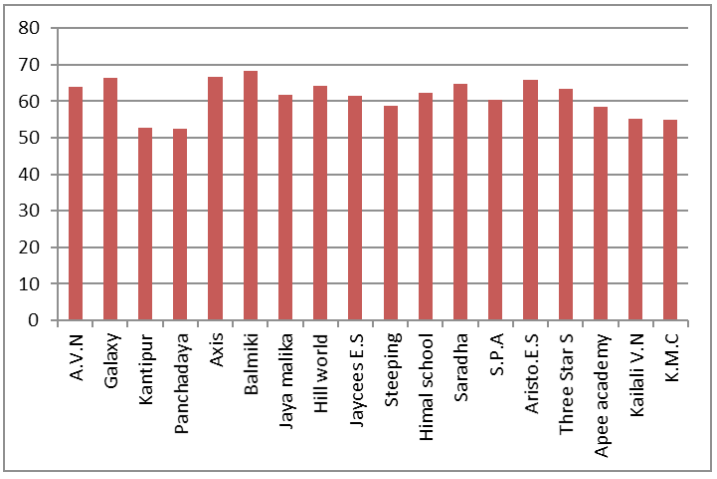


Figure 8 shows the comparison of average value of Leq at different locations. It can be seen that, Balmiki school has maximum noise level of 68.36 dB whereas Panchodaya school has minimum noise level of 52.54 dB. At majority of locations, average noise level was beyond 60 dB.

This study was limited to assess the noise level near educational institutions of Dhangadhi Sub-Metropolitan City. We found in majority of the locations value of Leq is more than 60 dB, which shows that the site was noise polluted area. We observed that near the chosen educational institutions the noise is due to vehicular traffic, which is in supportive with Baltrenas et al. (2010). Baltrenas et al. (2010) also argued that motor traffic causes noise pollution. Another important issue in Dhangadhi is that most of the roads are in construction and reconstruction phase by which condition of existing road is very worse. Because of bad condition of the road, the chance of noise pollution increases. As the chosen institutions are located in the city of Dhangadhi, there were many construction related work going on which also produces noise. This is also supported by Singh et al. (2022), as they mentioned construction of infrastructure and road cause the noise pollution. To reduce the noise level, the noise related policy have to be implemented strictly. The poor conditioned vehicles should not be allowed to ride in the road as they also cause noise pollution. Chhetri et al. (2019) also suggest to strictly regulate the noise policy to avoid or less the noise pollution. Unnecessary use of pressure horns also increased a noise level which is supported by Bhattarai (2014).

Conclusion

This study aimed to measure the noise level in Dhangadhi Sub-Metropolitan City. This study showed that the educational institutions which were adjacent to crowded road were found to be noisier. In majority of the locations, the average noise level was found more than 60 dB. This study reveals that transportation is the major source of noise pollution. Apart from that, condition of road, bad condition of vehicle also causes noise pollution. It was also observed that people have lack of awareness about the harmful effects of noise pollution. To control the noise pollution, a noise control policy needs to be formulated for this Sub-Metropolitan City and it should be implemented strictly. More importantly, the public awareness needs to be spread to people so that they can also understand the adverse effects of noise pollution leading to reduce noise pollution by some amount.

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