Traffic noise pollution assessment along the Ring Road of Kathmandu Valley, Nepal

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Sound or noise pollution has become a pressing issue in the major cities of the world. The rapidly growing and densely populated Kathmandu city in Nepal is no exception. Traffic noise level data were recorded in the field using sound-level meters. Each observation session was for 3 h (8–11 am) and (3–6 pm) at an interval of 10 sec on working days. The vehicle flow status was studied by direct observation, while the time series of noise pollution data and vehicles registered were updated from secondary sources. Further, various noise descriptors like traffic noise level, noise pollution level, equivalent continuous sound level (*L*eq), minimum sound level and maximum sound level were determined to assess noise pollution. It was found that there was no significant difference in the descriptors between the morning and evening traffic flow periods at a 5% level of significance. At all the 20 studied road junctions, *L*eq exceeded 70 dB(A) surpassing the recommended levels of national as well as international noise standards. If the present noise pollution level persists in Kathmandu with the growing population and number of vehicles, it will increase the chances of adverse health effects on the population.

Keywords: Noise pollution, traffic noise index, sound level, Nepal.

NOISE pollution is considered one of the significant problems for the quality of life in urban areas worldwide[1]. Globally, urbanization is leading to an increase in road traffic, and consequently the construction of new roads, which affect the quality of life[2,3] by causing noise pollution[4,5]. Traffic noise is the result of a continuous flow of vehicles on the roads and noise pollution due to contact of tyres, squealing of brakes, poor maintenance of vehicles parts, unnecessarily blowing of horns, inadequacy of mufflers fitted into vehicles and the use of defective silencers[6–9].

Traffic noise is rated the worst environmental stressor after air pollution affecting human health[10,11]. For example, it is estimated that around 100 million people are exposed to harmful traffic noise levels, over 55 decibels (dB), in Europe[12]. Surveys conducted in Indonesia, Sri Lanka, India and Burma with the support of the World Health Organization (WHO) between 1997 and 2001 found that 8% to 24% of all age groups suffered from hearing impairment[13]. Moreover, exposure to noise pollution entails adverse, accumulative and direct effects on human health, such as auditory loss, sleep disturbance, and cardiovascular and psycho-physiological problems[5,14–17]. WHO strongly recommends L_{den} (noise over the whole day) below 53 dB for traffic noise, below 54 dB for railway noise and below 45 dB for aircraft noise to prevent adverse health effects.

According to the Department of Transport Management (DoTM), Nepal, the number of motorized vehicles had increased 30.13-fold times from 1989 to 2016, with the total number of vehicles registered rising from 34,606 to 1,042,856 (ref. 18). There is an urgent need for noise-related studies, particularly in the sensitive areas in the developing countries[19]. Kathmandu in Nepal has been experiencing a rapid increase in urbanization, population and vehicular movement, with higher chances of noise pollution in recent decades. Similarly, traffic noise pollution causes significant health impacts in areas close to the main roads in Nepal[20]. There are few studies on noise pollution, especially at road junctions which encounter high noise levels[21]. Studies related to traffic noise pollution in Kathmandu Valley, Nepal, are available in the literature[14,15,22–27]. Recently, Chauhan *et al.*[28] studied noise pollution and the effectiveness of policy interventions for its control in Kathmandu Valley. They found that the average noise level of Kathmandu was recorded as 66.8 dB(A), with the highest level in high traffic zones, followed by commercial, low traffic and residential zones. They concluded that at 65.2% of the sampled sites, the noise level was beyond the permissible limit of WHO and the National Sound Quality Standard of Nepal[29].

A few earlier studies had explored fragmented noise pollution levels when the population was low. The increasing population rate, urbanization and rise in the number of vehicles over time are contributing to noise pollution. To the best of our knowledge, there are no previous studies in Nepal dealing with several road junctions simultaneously and estimating the number of vehicles. Thus, the present study to fills this gap by highlighting the status of noise pollution levels at almost all the road junctions along the Ring Road of Kathmandu Valley, Nepal.

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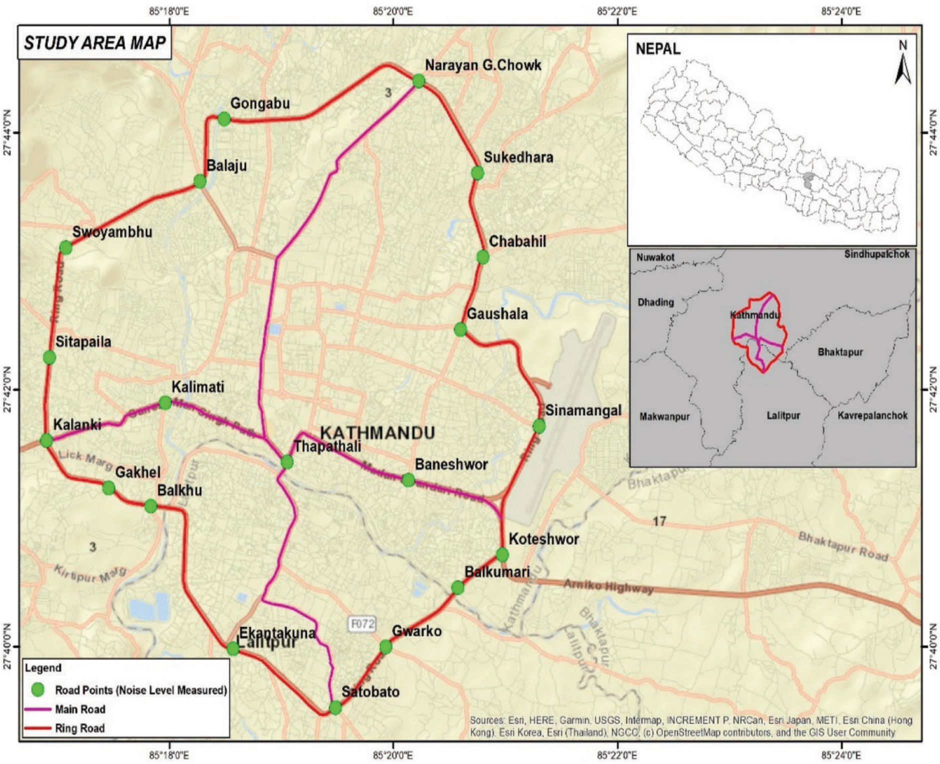

Figure 1. Map of the study area along with the sampling locations in Nepal.

Materials and methods

Study area

The study was conducted at 20 major road junctions along the Ring Road of Kathmandu Valley, located between lat. 27°32′13″ and 27°49′10″N and long. 85°11′31″ and 85°31′38″E. Kathmandu Valley comprises of three districts – Kathmandu, the capital city, Lalitpur, and Bhaktapur with a total of approximately 665 sq. km (Figure 1). It is a bowl-shaped valley, located in the subtropical to the temperate zone, with a centripetal drainage river system. The Kathmandu Valley along the ring road has a radial road network pattern. Urban areas have expanded along the major feeder roads radiating from the Ring Road, whose total length is 27 km.

Data collection

All noise-level measurements were taken on-site under suitable meteorological conditions with no rainfall and no winds for possible background noise error minimization. Secondary data such as the number of vehicles registered under the Government of Nepal were obtained from the Department of Transport and Management[18] (Appendix 1, Table A3). The spatial analysis was done using ArcGIS (10.3) to determine the present noise level at the different studied sites.

Fieldwork was carried out once in each station during March–April 2017 using standard sound level meters (TM 103 and TM 107). Data were recorded at every 10-sec interval. The total monitoring time for data collection was 6 h/day, i.e. morning period (8:00–11:00 am) and evening period (3:00–6:00 pm) during high traffic flow on working days. The instrumentation and calibration of the sound level meters were performed using the procedure recommended by the manufacturer. The measured data were then downloaded from the instrument and various noise-level indices such as traffic noise level (TNI), noise pollution level (NPL), equivalent continuous sound level (Leq), minimum sound level (Lmin) and maximum sound level (Lmax). Sound level (dB) that exceeded 10% of the time over the measurement period (L_{10}), sound level (dB) that exceeded 50% of the time over the measurement period (L_{50}) and sound level (dB) that exceeded 90% of the time over the measurement period (L_{90}) were estimated using eqs (1)–(4) below. Data analysis was carried out in MS Excel and a map was prepared using ArcGIS.

$$LAeq = 10\log\,[1/T\,(10_1^L/10 + 10_2^L/10 + \cdots + 10_n^L/10)], \quad (1)$$

where LAeq is equivalent A weighted sound pressure level (dB), T the total time in units, L the noise level (dB) and n is the number of events.

$$i = (P/100) * n, \quad (2)$$

where i is the position of the Pth percentile, P the percentile of time and n is the number of values in a data set (sorted from smallest to largest).

Total annoyance caused by noise level was estimated using NPL (ref. 30).

$$L_{NP} = Leq + k\sigma, \quad (3)$$

where Leq is the equivalent noise level measured (dB(A)), k a constant which is provisionally given the value 2.56 and σ is the standard deviation of instantaneous sound levels with time. This measurement system applies to any environment, unlike those specifically concerned with aircraft and traffic.

Annoyance response due to traffic noise was computed using the following formula[31].

$$TNI = 4(L_{10} - L_{90}) + (L_{90} - 30). \quad (4)$$

Vehicle flow count

The tally method was employed to count the vehicle flow number (traffic flow). Vehicles were classified as heavy (truck, bus, bulldozer, trailer, dumper), medium (car, jeep, auto-rickshaw, loading rickshaw) and light (motorcycle, scooter) based on their size. Two groups were independently assigned to vehicle count to minimize counting errors.

Hypothesis testing

The t-test hypothesis was performed between the morning and evening noise levels, assuming that the two means are equal. The noise parameters such as Leq, L_{10}, L_{50}, L_{90}, Lmax and Lmin were tested at 5% level of significance in two-tailed tests.

Results and discussion

The noise level status at all the sampling locations was assessed along with the traffic flow status and composition in the urbanized, burgeoning Kathmandu city.

Traffic flow volume

The vehicle flow density is one of the important drivers of noise pollution and plays a vital role in traffic noise. The minimum number of vehicles observed per day was 7770 and the minimum vehicle flow density observed per hour was 1295 vehicles at Gakhel. The maximum number of vehicles observed per day was 57,946 and the maximum vehicle flow density observed was 9658 vehicles at New Baneshwor. However, more than 5000 vehicles were observed per hour at stations such as Koteshwor, Gaushala, Narayan Gopal Chowk and Thapathali. The total number of vehicles plying on the road at 20 stations per day was estimated as 465,721 and vehicle flow density was 77,620 vehicles (Figure 2 *a* and Appendix 1, Table A3). The composition of vehicles was dominated by two-wheelers (Figure 2 *b*), which indicates that urban traffic is primarily composed of two- and three-wheelers and that the movement of four-wheelers such as buses, lorries, trucks, etc. was relatively less at the sampling locations. This result was consistent with those of studies done in different cities of India[3,4,10,32,33,36], which also reported that increase in the number of two-wheelers had increased the traffic volumes, making it difficult in early urban planning. Also, the number of registered vehicles per year has been increasing in Kathmandu Valley (Appendix 1, Table A3). Assessment of noise generated due to vehicular traffic has been reported in various cities like Asansol, Aurangabad, Tangail, Amman, Tirupur, Quetta and Lanzhou[4,11,34–38].

Assessment of noise descriptors

Table 1 presents the noise level status based on various noise indices.

Traffic noise level and noise pollution index

TNI assesses the annoyance of the exposed population due to traffic movement[33]. Maximum TNI was observed at Kalanki (90.9 dB(A)), while the minimum was observed at Ekantakuna (70.9 dB(A)), indicating high noise levels in urban areas of Nepal (Figure 3). This result is supported by a study done in an urban environment in Eastern India by Das *et al.*[10], who found that traffic noise and construction works were the major sources of noise pollution. Similarly, NPL was found to be 88.7 dB(A) at Sinamangal, while the lowest NPL of 78.2 dB(A) was observed at Balaju (Table 1). The noise pollution levels at all the sites exceeded 75 dB(A), indicating hazardous conditions[30,34].

Equivalent continuous sound pressure level in Kathmandu Valley

The average value of equivalent continuous sound level (Leq) was found to be 76.3 dB(A) in Kathmandu Valley, indicating exceedance of the permissible limit as prescribed by the Government of Nepal for residential and commercial areas (Appendix 1, Tables A1 and A2). Such high noise levels indicate that cities have been exposed to traffic noise pollution, which may cause serious annoyance[37,39]. The highest equivalent sound pressure level (Leq) at most locations exceeded 75 dB(A), with the highest of 80.8 dB(A) and the lowest of 71.0 dB(A) (Table 1, Figure 4 *a*). This value was close to that reported in a study done in Siddharthanagar Municipality at Rupandehi of Nepal[14]. Similarly, a study on noise pollution and the effectiveness of policy

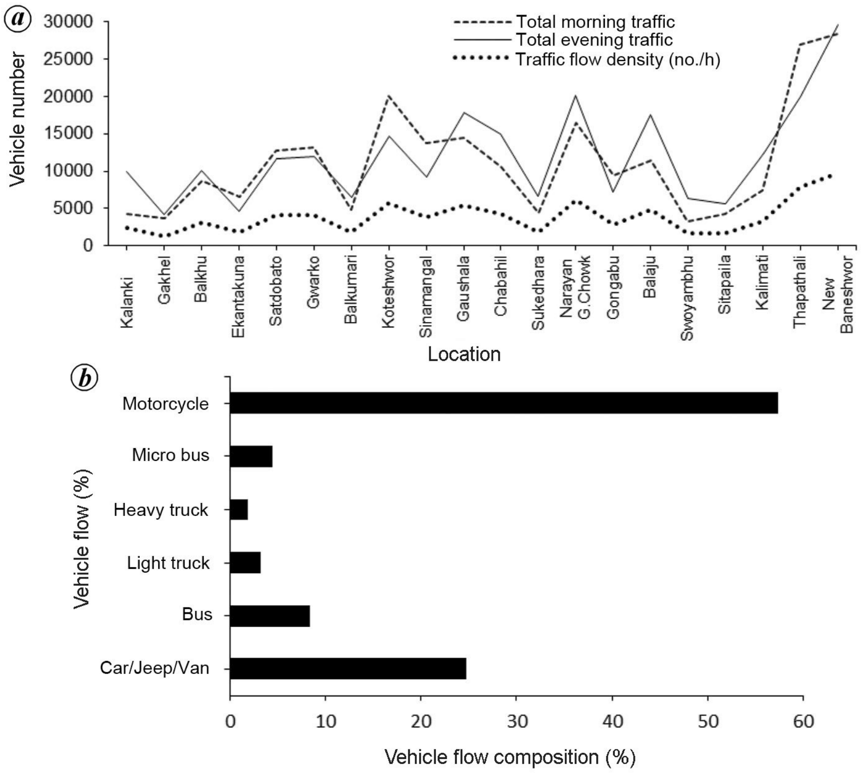

Figure 2. ***a***, Traffic volume and flow density along the Ring Road in Kathmandu Valley, Nepal. ***b***, Percentage distribution of different vehicle types.

Table 1. Noise descriptors (dB(A)) of all stations in Kathmandu Valley, Nepal

Location	Latitude	Longitude	*L*eq	*L*max	*L*min	TNI	NPL	L_{10}	L_{50}	L_{90}
Kalanki	85.28	27.69	78.8	97.3	67.0	90.9	87.3	80.8	74.7	71.4
Gakhel	85.29	27.69	74.2	99.5	48.1	76.2	84.4	75.3	68.6	60.5
Balkhu	85.3	27.68	79.7	99.9	65.7	78.7	86.0	81.1	75.4	71.5
Ekantakuna	85.31	27.67	71.0	90.1	57.0	70.9	78.9	73.2	67.9	64.0
Satdobato	85.32	27.66	75.4	90.6	64.9	73.1	82.4	78.0	72.8	69.5
Gwarko	85.33	27.67	77.5	93.9	66.9	74.7	84.2	79.8	74.6	71.3
Balkumari	85.34	27.67	79.3	100.3	60.6	79.7	83.8	77.1	70.8	66.4
Koteshwor	85.35	27.68	79.9	98.8	68.0	79.5	86.9	81.6	76.2	72.4
Sinamangal	85.36	27.7	80.9	100.5	63.4	85.8	88.7	81.6	74.9	69.9
Gaushala	85.34	27.71	77.6	97.3	65.6	76.3	83.4	78.9	73.3	69.4
Chabhahil	85.35	27.72	80.0	101.7	67.5	75.9	85.1	80.5	75.6	71.9
Sukhedhara	85.35	27.73	75.1	97.2	56.3	72.1	84.9	76.1	70.9	65.5
Maharajgunj	85.34	27.74	72.0	97.1	58.0	72.6	78.6	72.8	67.0	62.8
Gongabu	85.31	27.74	75.3	95.6	60.6	76.9	81.4	75.1	68.6	64.8
Balaju	85.3	27.73	71.2	91.7	60.0	71.9	78.2	72.8	66.7	63.3
Swayambhu	85.28	27.72	74.6	96.3	56.5	74.7	81.3	75.4	70.1	65.2
Sitapaila	85.28	27.7	72.5	88.9	58.9	74.2	80.7	74.9	69.4	64.9
Kalimati	85.3	27.7	77.4	96.1	66.4	74.7	84.3	79.1	74.5	70.8
Thapathali	85.32	27.69	76.3	99.9	65.9	73.7	83.1	77.9	73.3	70.0
New Baneshwor	85.34	27.69	77.6	94.6	67.0	73.2	84.4	80.0	75.7	71.9

Source: Field survey, 2017. NPL, Noise pollution level; TNI, Traffic noise index; *L*max, Maximum sound level; *L*min, Minimum sound level; *L*eq, Equivalent noise level; L_{10}, L_{50} and L_{90}: A-weighted decibel levels exceeded 10%, 50% and 90% of the time respectively.

interventions for its control in Kathmandu by Chauhan *et al.*[10] along the Ring Road also found that the average noise level of Kathmandu Valley was 66.8 dB(A), with the highest in high traffic zones. The study also indicated that the noise level was beyond the permissible limits of WHO and the National Ambient Sound Quality Standard of Nepal[29].

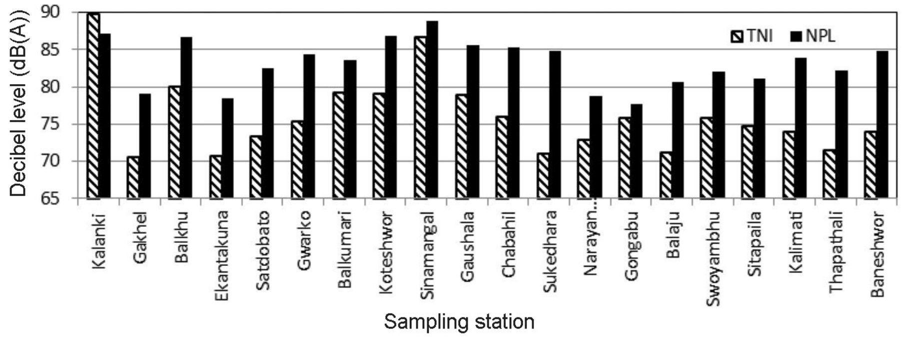

Figure 3. Traffic noise index (TNI) and noise pollution level (NPL) along the Ring Road stations.

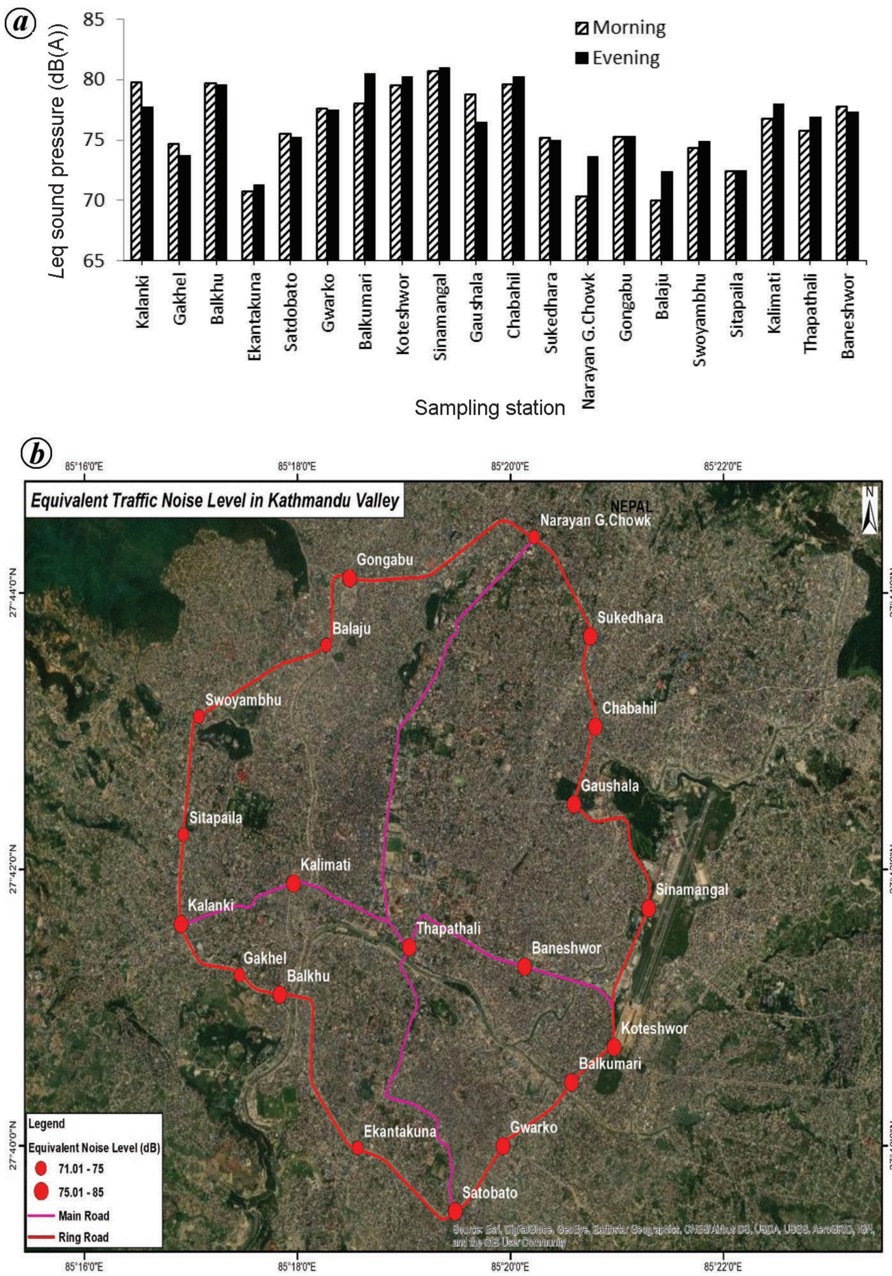

Figure 4. ***a***, Equivalent continuous sound pressure level (dB(A)) at Kathmandu Road stations in the morning and evening. ***b***, Spatial map showing equivalent continuous sound pressure level (*L*eq, dB(A)).

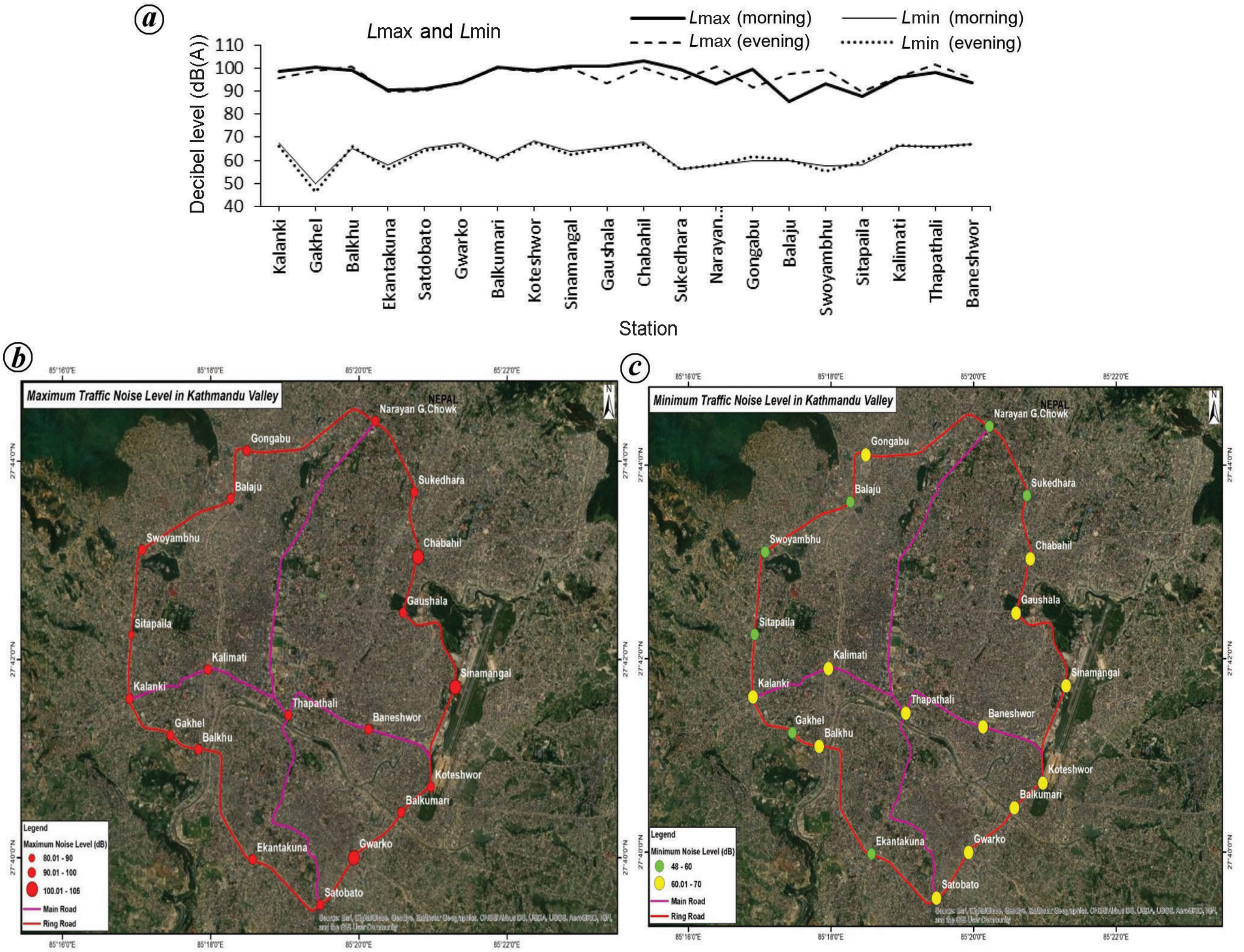

Figure 5. ***a***, Maximum and minimum equivalent noise levels at the Kathmandu Road stations. ***b***, Maximum equivalent noise level (*L*max). ***c***, Minimum equivalent noise level (*L*min).

The equivalent continuous sound pressure level (*L*eq) in the morning (mean = 76.15, SD = 3.32, $n = 20$) was hypothesized to be equal to *L*eq in the evening (mean = 76.46, SD = 2.94, $n = 20$). This means the null hypothesis is accepted at 5% level of significance ($\alpha_{0.05}$), t (38) = –0.30 and t-critical = 2.02, P-value = 0.76 (two-tailed test).

Figure 4 *b* reveals in most of the stations noise level exceeded the prescribed limits by WHO as well as the Nepal government (Appendix 1, Table A2). WHO has clearly stated that 60 dB(A) sound can result in temporary hearing impairment while 100 dB(A) sound can cause permanent hearing impairment. Hence, the immediate development of a green belt in these zones is essential to bring down the noise level within limits prescribed by the Government of Nepal and the WHO community noise guidelines. In Messina, Italy, the equivalent sound levels exceeded 75 dB(A), resulting in more than 25% of the population in distress. Results of the present study are also in agreement with the study done at Alexandria, Egypt[40].

Maximum and minimum sound levels

Among all the studied stations along the Ring Road, the minimum sound level (*L*min) ranged from 48.1 to 68.0 dB(A), which could be due to the free flow of traffic without any hindrance, as it often happens at the crossroads. While the highest sound level (*L*max) of 101.7 dB(A) was observed at Chabahil, one of the busiest crossroads in Kathmandu Valley (Table 1). The maximum noise level at present is low compared to 110.2 dB(A) observed at Banepa[24]; however, it exceeded the permissible level at the locations, except at Balaju, Satdobato and Ekantakuna (Appendix 1, Table A2). In general, we can observe the consistency in the minimum noise levels in the morning and evening compared to *L*max (Figure 5 *a*). The maximum values were close to 101 dB(A) at Alexandria, occurring in the daytime at road junctions[41]. The *L*max of morning (mean = 96.24, SD = 4.85, $n = 20$) was hypothesized to be equal to *L*max of evening (mean = 96.44, SD = 3.93, $n = 20$). This means

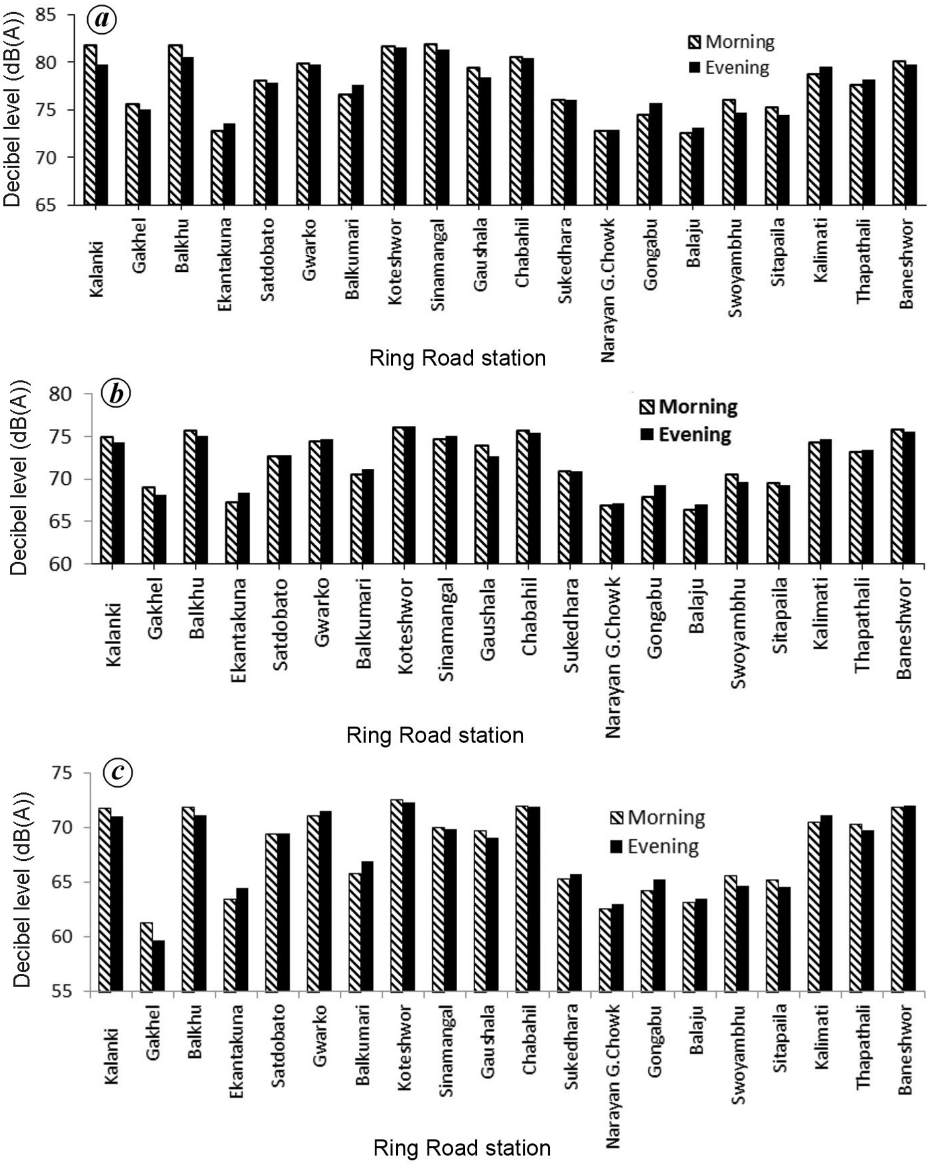

Figure 6. Sound level (dB(A)) exceeded over (***a***) 10%, (***b***) 50% and (***c***) 90% of the time over the measurement period.

the null hypothesis is accepted at 5% level of significance ($\alpha_{0.05}$), t (38) = –0.14 and t-critical = 2.02, P-value = 0.88 (two-tailed test). *L*min of morning (mean = 62.42, SD = 5.08, n = 20) was hypothesized to be equal to *L*min of evening (mean = 61.94, SD = 5.52, n = 20). This means the null hypothesis is accepted at 5% level of significance ($\alpha_{0.05}$), t (38) = –0.28 and t-critical = 2.02, P-value = 0.77 (two-tailed test).

Spatial analysis of sound level

Figure 5 *b* and *c* represent spatial analysis of maximum (*L*max) and minimum (*L*min) sound levels. As shown in Figure 5 *b*, *L*max ranges from 80 to 100 dB(A) and *L*min from 48 to 70 dB(A).

Percentile sound level

The L_{10}, L_{50} and L_{90} values that exceeded 10%, 50% and 90% of the time over the measurement period of all the 20 stations are presented here (Table 1, Figure 6 *a*–*c*). The average statistical values for sound levels that exceeded 10% of the time over the measurement period were in the range 72.5–81.9 dB(A) and values that exceeded 50% of the time over the measurement period were between 63.3 and 76.05 dB(A). Whereas values for sound levels that exceeded 90% of the time over the measurement period ranged from 60.47 to 72.4 dB(A). Both the highest and lowest values of L_{10} of the present study exceeded the acceptable value of 66.0 dB(A) as reported by Longdon[42]. According to the guideline value of Nepal, L_{10} values should be 77.02 dB(A) (Appendix 1, Table A2) for residential

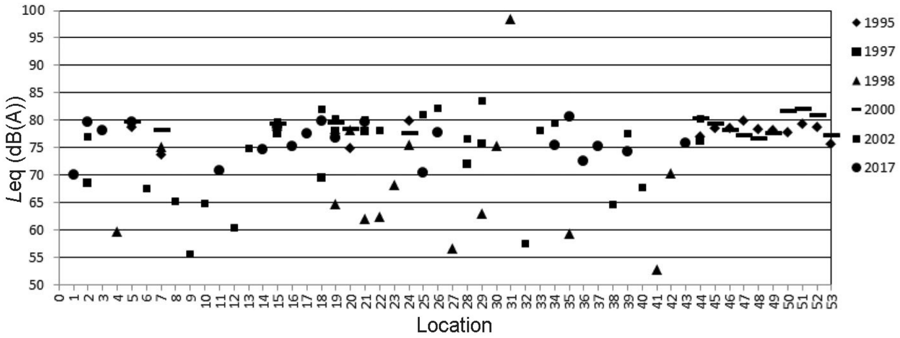

Figure 7. Time series (1995–2017) noise level (*L*eq) in Kathmandu Valley[41]. Note: 1. Balaju, 2. Balkhu, 3. Balkumari, 4. Basantpur, 5. Chabahil, 6. Chyasal, 7. Darbar Marg, 8. Dhapagal, 9. Dhapakhel, 10. Dhobighat, 11. Ekantakuna, 12. Gabahal, 13. Gairidhara Chowk, 14. Gakhel, 15. Gaushala, 16. Gongabu, 17. Gwarko, 18. Kalanki, 19. Kalimati, 20. Keshar Mahal, 21. Koteshwor, 22. Maitidevi, 23. Mangal Bazar, 24. Minbhawan, 25. Narayan G. Chowk, 26. New Baneshwor, 27. New Road, 28. Pulchowk, 29. Putalisadak, 30. Ratna Park, 31. Sahid Gate, 32. Samakhusi, 33. Sangrila Hotel, 34. Satdobato, 35. Sinamangal, 36. Sitapaila, 37. Sukedhara, 38. Swanmala Tole, 39. Swoyambhu, 40. Taumadi Tole, 41. Teaching Hospital, 42. Thamel, 43. Thapathali, 44. Tripureswore, 45. Teku, 46. Sundhara, 47. RNAC, 48. Bir Hospital, 49. Gyaneswor, 50. Battisputali, 51. Bijuli Bazar, 52. Maitighar and 53. Shukrachowk.

and commercial areas, which was exceeded at all the locations in the present study. This result is consistent with that of a study conducted at four sites in Gwalior city, India where Marathe[43] reported that L_{10} values were higher than acceptable limits at all the studied places. L_{10} in the morning (mean = 77.64, SD = 3.10, $n = 20$) was hypothesized to be equal to L_{10} in the evening (mean = 77.52, SD = 2.85, $n = 20$). This means the null hypothesis is accepted at 5% level of significance ($\alpha_{0.05}$), t (38) = 0.12 and t-critical = 2.02, P-value = 0.90 (two-tailed test). Moreover, L_{50} exceeded at most of the locations, except at Gakhel, Ekantakuna, Maharajgunj, Gongabu, Balaju, Swayambhu and Sitapaila (Appendix 1, Table A2). The L_{50} in the morning (mean = 77.64, SD = 3.18, $n = 20$) was hypothesized to be equal to L_{50} in the evening (mean = 72.03, SD = 3.11, $n = 20$). This means the null hypothesis is accepted at 5% level of significance ($\alpha_{0.05}$), t (38) = 0.004 and t-critical = 2.02, P-value = 0.99 (two-tailed test).

L_{90} in the morning (mean = 67.85, SD = 3.76, $n = 20$) was hypothesized to be equal to L_{90} in the evening (mean = 67.85, SD = 3.71, $n = 20$). This means the null hypothesis is accepted at 5% level of significance ($\alpha_{0.05}$), t (38) = 1.2E^{-14} and t-critical = 2.02, P-value = 1 (two-tailed test). The background noise level (L_{90}) in all the studied locations was high, which may affect the health of people residing around these areas due to undesired noise resulting in annoyance and disruption of their daily lives[44]. Based on the recommendation of the United States of Department of Housing and Urban Development (HUD) for residential areas, 50% of the stations fall under normally unacceptable {62 dB(A) ≤ LAeq ≤ 76 dB(A)} and the rest 50% of the stations fall under unacceptable noise levels (LAeq ≥ 76 dB(A)). Also, a study conducted in Curitiba, Brazil, confirmed that in 93.3% of cases, Leq was higher than 65 dB(A) (usually unacceptable) and in 40.3% of cases Leq was more than 75 dB(A), which was unacceptable[45]. In this context, assessing the noise level using appropriate mitigation measures is essential.

Traffic noise in Kathmandu Valley

The average noise level in Kathmandu Valley at different stations over the years ranged between 55 and 80 dB(A) (Figure 7). In comparison with the Noise Level Standard of Nepal[29], in most stations, noise levels exceeded the daytime level of 75 dB(A) in an industrial area (Appendix 1, Table A2).

In Nepal, the law related to sound quality standards was published on 15 October 2012 by the Ministry of Science, Technology and Environment[29]. Further, rules like the green sticker system for vehicles have been suggested to promote environment-friendly technology and investment; the ‘No Horn Please’ rule was enforced on 3 April 2017 to be effective from 14 April 2017 under section 164(c) of the Motor Vehicle and Transport Management Act, 1999 (ref. 46). However these legislative methods (such as laws and standards) do not seem to be effective in resolving noise pollution.

Conclusion

This study estimates the sound pressure level at 20 road junctions along the Ring Road in the Kathmandu Valley. Based on the various noise descriptors, we conclude the following:

- The results revealed that the noise descriptors like Leq, L_{10}, L_{50}, Lmax exceeded the permissible limits at all the stations. The traffic composition was dominated by motorcycle types contributing to high traffic volume.
- There was no significant difference in the noise pollution indices between morning and evening traffic flow periods. Therefore, concerned agencies should take noise pollution control measures during both periods simultaneously.
- There is an urgent need for the intervention of the management and the system designers to make and implement effective city plans to curb the adverse effects of noise pollution and ensure the health, and safety of the public.

Appendix

Table A1. Noise level (dB(A)) in different areas of Kathmandu Valley, Nepal

	Noise level equivalent				
Area	Leq	L_{10}	L_{50}	L_{95}	Lmax
High traffic	78.97	80.97	75.34	69.04	97.11
Low traffic	75.21	78	71.96	64.02	94.19
Public places	69.67	72	67.04	62.34	86.82
Residential and commercial places	74.52	77.02	70.44	63.38	92.27

Table A2. National Ambient Sound Quality Standard, 2012

	Permissible limits dB(A)	
Zone	Day	Night
Industrial zone	75	70
Commercial zone	65	55
Rural residential zone	45	40
Urban residential zone	55	50
Mixed residential zone	63	55
Silence zone	50	40

Source: CBS, 2019 (Ministry of Environment, Science and Technology, Nepal Gazette 2069/07/13).

Table A3. Traffic volume at stations along the Ring Road of Kathmandu Valley

Station	Morning (8–11 am)	Evening (3–6 pm)	Total vehicles (6 h)	Vehicle flow/h
Kalanki	4,336	9,922	14,258	2,376
Gakhel	3,629	4,141	7,770	1,295
Balkhu	8,739	10,028	18,767	3,128
Ekantakuna	6,625	4,660	11,285	1,881
Satdobato	12,788	11,625	24,413	4,069
Gwarko	13,137	11,992	25,129	4,188
Balkumari	4,810	6,461	11,271	1,879
Koteshwor	19,999	14,640	34,639	5,773
Sinamangal	13,704	9,175	22,879	3,813
Gaushala	14,455	17,868	32,323	5,387
Chabahil	10,580	14,901	25,481	4,247
Sukedhara	4,446	6,664	11,110	1,852
Narayan G. Chowk	16,433	20,072	36,505	6,084
Gongabu	9,477	7,263	16,740	2,790
Balaju	11,428	17,603	29,031	4,839
Swoyambhu	3,297	6,408	9,705	1,618
Sitapaila	4,209	5,664	9,873	1,646
Kalimati	7,459	12,291	19,750	3,292
Thapathali	26,932	19,914	46,846	7,808
New Baneshwor	28,329	29,617	57,946	9,658

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