Impact of Sound Pollution at Lahan City, Siraha, Nepal

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Abstract

*The researcher in this paper tried to find the causes, impacts of sound pollution and a modeling of Noise index in Lahan city. Quantitative research approach by using scientific techniques and tools was used to measure intensity level of sound on public and economic sites. The study exposed a modeling to Noise index as excess Equivalent Sound Pressure Leve (L_{eq} = **86.88 dB** in Day shift), Noise Pollution Index (LNP=**119.17 dB** in Day shift), Noise climate (NC=**31.4 dB** in Day shift) and Traffic Noise Index (TNI=**157.3 dB** in Day shift) which have explored that the public health falls under the danger zone beyond normal standard conservation of hearing **(60dB)**. It is recommended that authorities have main responsibility to extend market policy and safety precaution to rescue the sensitive sites of Lahan city from sound pollution.*

Keywords: Adverse effects, Noise indices, Pollutants, Sound level meter

Introduction

Noise, from the Latin "nausea," signifies unwanted or unpleasant sound. Major cities face rising sound pollution due to places urbanized. Key sources include increased vehicles, construction, and urbanization. In Europe at night, WHO's has recommended 30-35 dB for undisturbed sleep (Chauhan et al., 2010). As development progresses and environmental challenges like air and water pollution, biodiversity loss, and climate change intensify, noise pollution is becoming a growing concern in urban areas. However, in many developing nations, this issue remains largely unrecognized and insufficiently addressed (Bhosale et al., 2010). In Eastern Nepal, environmental noise levels frequently exceed standards. Dharan's measurements range from 58 to 82 dB(A) while Inaruwa's range from 53 to 77 dB(A) seasonally (Shrestha et al., 2017). Traffic significantly contributes to urban noise pollution, impacting residents' health. The effects of noise vary with frequency and include potential hazards from high-intensity sounds. Urban expansion, such as infrastructure and traffic growth, exacerbates noise, while loud horns, speakers, and

DJ sounds during events further contribute to health risks (Saraswat, 2018). Approximately 250 million people worldwide are affected by occupational noise exposure, with 16%, varying from 7% to 21% regionally. (Paudel et al., 2019). City noise pollution sources include police and ambulance sirens, car horns, heavy traffic, sound systems, places of worship, public meetings, motorbikes, loudspeakers, repair workshops, construction, factories, loud voices, and planes (Hoque et al., 2020). Evening measurements showed S18 recorded highest noise, averaging 68.43 dB (Ali et al., 2021). Traffic noise is elevated in cities due to high population density, frequent movement, and increasing vehicles (Sahu et al., 2021). Traffic noise often exceeds 70 dBA on collector, arterial, and highway roads (Ali, 2022).

In Kathmandu, noise pollution levels consistently exceed 70 dB (A) at all 20 studied junctions, with there is no substantial variation between morning and evening Persistent high sound pollution could harm public health (Singh et al., 2022). In Kathmandu, noise levels surpass national and WHO limits, with peak readings at Amrit Campus and Banasthali. Automobiles and loudspeakers are main noise sources. Public education is crucial for control (Chand et al., 2022). Many people are unaware of noise pollution, despite its significant impact. This lack of awareness contributes to rising noise levels. Increasing public awareness is crucial to addressing the issue (Uddin, 2018). Field measurements show that traffic noise averages over 68 dB in the mornings and afternoons, exceeding WHO guidelines and potentially causing disturbance (Ali et al., 2021).

Adverse Effects of Excessive Sound

The WHO identifies seven noise pollution impacts: hearing loss, social issues, communication interference, sleep disruption, cardiovascular problems, and mental health disturbances (Jariwala et al., 2017). Hearing impairment involves a partial or total inability to hear sounds. Chronic exposure to noise above 75 dB (A) can cause health problems like hearing loss, with prolonged noise affecting cochlear hair cells, resulting in Noise-Induced Hearing Loss (NIHL) and potential acoustic trauma (Mohamed et al., 2020). Noise-Induced Hearing Loss (NIHL), the second leading cause of sensorineural hearing loss after age-related decline, affects roughly 5% of the global population, with major physical, mental, social, and economic consequences (Dobie, 2014). A qualitative study identifies negative attitudes, avoidance behaviors like moving house, and health and relationship issues related to the problem and relevant authorities (Park & Lee, 2015). The study shows that speech errors lower user acceptance but reveals no significant impact on workload or physiological factors like heart rate and skin conductance; industrial noise affects word error rates more than information transfer in speech commands (Rosilius et al., 2024). Noise affects sleep by altering heart rate, blood

flow, breathing, and other systems. Habituation varies by noise type and level. In work settings, shift work and stress also impact sleep quality (Kawada, 2011). Studies show that noise pollution raises hypertension rates, a major risk factor for cardiovascular disorders. In developing countries, rising hypertension may be linked to persistent noise. Without government action to address this, cardiovascular disease could become widespread (Aluko & Nna, 2015). Noise sensitivity significantly associates with internalizing, externalizing, and total behavioral problems, particularly in low-income groups. Recent evidence shows traffic noise, especially aircraft noise, increases depression risk by 12% per 10 dB LDEN. Road and railway noise have minor effects, and gaps in research on anxiety, dementia, and cognitive decline persist (Health & Review, n.d.). Urbanization and pollution, including noise, are associated with cardiovascular, metabolic, and psychiatric disorders. A review of 40 studies highlights noise's role in affective disorders, particularly for vulnerable groups. Using GEDA 2012 data, in Germany, high levels of noise annoyance are associated with worsened mental health. Further research is needed (Hammersen et al., 2016).

Threshold Noise level in Nepal

The government of Nepal has formulated noise level standard for different areas for day and night time is given in Table 1.

Table 1

Noise level standard of Nepal

Area	Noise Level (dB)	
	Day time	Night Time
Silent zone	50	40
Industrial area	75	70
Business area	65	55
Residential area	45	40
Urban residential area	55	45
Mixed residential area	63	40

Source: (Campus, 2019)

Method and Materials

Study area

Lahan City, located in the eastern Siraha district along the Mahindra Highway (East-West Highway), is approximately 350 km (99.3 miles) east of Kathmandu. Positioned at a latitude of 26.7297° N and longitude of 86.4794° E, Lahan faces ecological challenges due to urbanization, rapid population growth, and a high

volume of daily vehicle registrations. The city is divided into twenty-four wards, each with detailed household and population data (NCS, 2011).

Sampling sites

In this study, the southeastern part of Lahan City in Nepal was chosen for analysis. Seventeen sampling points were selected, including traffic areas, residential areas, silent zones, and commercial areas. Traffic areas included East Bus Station, West Bus Station, Ramesh Chowk, and Radha Krishna Chowk. Residential areas were Padariya Chowk, Bastipur, and Bhadiya. Silent zones comprised Pashupati Ma. Bi., Sankalpa Vidhyashram, JSMMC Lahan, Choudhary Eyes Hospital, Friends Model Hospital, Saptarishi Hospital, and Lahan Cancer Care Hospital. Commercial areas included New Vegetable Market and Ghantaghar.

Table 2

Classification of standard areas related to Lahan City on basis of Geographic Co-ordinates (GC's)

Area	Location	GC's	
		Latitude	Longitude
Traffic Area	East bus station	26.7155469N	86.4713991E
	West bus station	26.7932473N	86.3283469E
	Ramesh chowk	26.7126859N	86.4791589E
	Radha Krishna chowk	26.7280902N	86.4799319E
Residential Area	Padariya Chowk	26.7190066N	86.4630022E
	Bastipur	26.7462382N	86.4399140E
	Bhadiya	26.7562614N	86.4819637E
Silent Area	Pashupati ma.bi	26.7297827N	86.4794697E
	Sankalpa Vidhyashram	26.7108593N	86.4824529E
	JSMMC Lahan	26.7297366N	86.4688232E
	Choudhary eyes hospital	26.7102407N	86.4927968E
	Friends Model hospital	26.7096743N	86.4894849E
	Saptarishi Hospital	26.7062764N	86.4989036E
	Lahan Cancer care hospital	26.7191364N	86.4801289E
Commercial Area	New vegetable market	26.7244680N	86.4782977E
	Ghantaghar	26.7183570N	86.4815101E

Material

Table 3

Technical Specification of Sound Level Meter

Measuring Range	30~130dBA
Accuracy	±1.5dB
Frequency Response	31.5Hz~8KHz
Frequency Weighting Response	A Weighting
Resolution	0.1db
Power Source	3*1.5V AAA Batteries
Working Temperature and Humidity	$0~40^0$C, 10~80%RH
Storage Temperature and Humidity	$-10~60^0$C, 0~90%RH
Weight	84.08g (Excluding Battery)
External Dimension	50*33*159.5mm

Measuring instrument

(Sound Level meter SL-4010)

The appearance design of digital sound level meter is novel, small and portable. The digital sound meter is applicable for measurement of noise engineering, quality control, health prevention and various environment noise, including noise measurement in such various places as factories, offices, transporting routes, families, stereo equipment and other places.

Method

For recording data, there seventeen different sample places are taken at random considering certain criteria such as high traffic zones, main trade centers, salient areas and residential areas. At each location data are taken in three shifts (Morning at time from 9:05 to 9:55, day at time from 1:05 to 1:55 and evening at time from

5:05 to 5:55). The sound level meter was placed on its stand of one meter height and distance of 5 meter from central road on main junctions whereas central part of trade centers. While taking observation sound level meter was set to response fast and selected dB (A).

Formulation- need of theory

Weight Decibel Level (Lx)

The noise level exceeded for x percentage of time is denoted by Lx. The most common noise exceeded level is used is L_{10} noise level which means noise level exceeding for 10% of time and calculated as 10^{th} percentile of data. Noise level exceeding for 50% and 90% are respectively denoted by L_{50} and L_{90} are calculated as 50^{th} and 90^{th} percentile of data.

Equivalent Sound Level (Leq)

It is the equivalent continuous noise level measured over a given period measured continuously at a particular point. It is measured by the equation (Roy et al., 2022):

$$L_{eq} = 10 \log(\frac{1}{10}\sum_{i=1}^{n} 10^{\frac{Li}{10}}) \quad (1)$$

Where Li is the i^{th} sound pressure level.

Noise Pollution Index (LNP)

LNP serves as an indicator of the pollution in the environment for physiological and psychological disturbance of the human body. It is given by the equation(Roy et al., 2022):

$$LNP = Leq + (L10 - L90) \quad (2)$$

Noise climate (NC)

Noise climate (NC) indicates the noise pollution level and is given by the relation(Roy et al., 2022):

$$NC = (L_{10} - L_{90}) \quad (3)$$

Traffic Noise Index (TNI)

Traffic noise index indicates the degree of variation or degree of annoyance in traffic flow and can be computed using the relation(Roy et al., 2022):

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

Meaning of L_{10} , L_{50}, L_{90}, L_{max}, and L_{min}

L_{10} is the sound level in dB that is exceeded 10% of the time over measurement period, L_{50} is the sound level in dB that is exceeded 50% of the time over measurement period, L90 is the sound level in dB that is exceeded 90% of the time over measurement period, L_{max} is the maximum sound level measured during the measurement period with the sound meter set on SLOW response and L_{min} is the maximum sound level measured during the measurement period with the sound meter set on SLOW response(Bhatarai et al., 2014).

Results and Discussion

Data section

Table 4

Weighted Decibel Levels

Location	Weighted Decibel Levels (Lx)		
	Morning (10:05-10:55)		
	L_{10}	L_{50}	L_{90}
East bus station	85.5	67.5	63.0
West bus station	92.3	83.5	61.7
Ramesh Chowk	96.0	85.0	69.9
Hospital Chowk	71.5	61.9	58.6
Ghantaghar	72.2	59.1	48.0
New Vegetable Market	78.02	72.1	66.9
Padariya Chowk	75.8	66.5	61.7
Pashupati Aadarsh ma.bi	53.2	49.7	46.3
Radha Krishna Chowk	79.8	67.2	64.6
Bastipur	54.4	48.1	45.5
Bhadiya	54.7	52.5	46.2
Sankalpa Vidhyashram Pvt.Ltd	74.0	63.4	55.9
J S Murarka Multiple Campus	64.8	59.6	54.4
Choudhary Eye Hospital	61.6	55.8	51.7
Friends Model Hospital	62.9	54.5	51.5
Saptarishi Hospital	60.8	52.9	49.6
Lahan Cancer Care Center	59.0	54.5	50.4

Table 4 shows the Weighted Decibel Levels (Lx) at 10%, 50%, and 90% for 17 locations during different shifts. In the evening, the Lx 10% value peaks at 96.0 dB at Ramesh Chowk and drops to 53.2 dB at Pashupati Aadarsh Ma. Bi. In the day shift, the Lx 50% value reaches a maximum of 85.0 dB at Ramesh Chowk and a minimum of 49.7 dB at Pashupati Aadarsh Ma. Bi. For the Lx 90% level, the highest value is 69.9 dB at Ramesh Chowk, while the lowest is 45.5 dB at Bastipur in the evening.

Table 5

Weighted Decibel Levels (Lx)

Location	Weighted Decibel Levels (Lx)		
	Day(1:05-1:55)		
	L_{10}	L_{50}	L_{90}
East bus station	93.1	83.5	61.7
West bus station	71.4	67.9	66.0
Ramesh Chowk	86.4	78.8	70.7
Hospital Chowk	80.9	75.0	61.4
Ghantaghar	69.8	61.7	58.3
New Vegetable Market	90.8	81.4	61.8
Padariya Chowk	71.6	68.0	64.2
Pashupati Aadarsh ma.bi	59.5	56.1	47.6
Radha Krishna Chowk	80.6	70.7	64.0
Bastipur	55.6	52.2	47.9
Bhadiya	60.3	54.0	47.0
Sankalpa Vidhyashram Pvt.Ltd	73.6	67.7	49.6
J S Murarka Multiple Campus	64.8	60.1	52.0
Choudhary Eye Hospital	63.0	60.3	53.1
Friends Model Hospital	64.3	56.6	55.3
Saptarishi Hospital	63.9	55.3	47.5
Lahan Cancer Care Center	56.5	50.7	46.0

Table 5 presents the Weighted Decibel Levels (Lx) at 10%, 50%, and 90% during the evening shift for 17 locations. The results show that the Lx 10% level peaks at 93.1 dB at East Bus Station and reaches a minimum of 55.5 dB at Bastipur during the day shift. For the Lx 50% level, the maximum is 83.5 dB at East Bus Station, while the minimum is 50.7 dB at Lahan Cancer Care Center in the day shift. The Lx 90% level is highest at 70.7 dB at East Bus Station and lowest at 46.0 dB at Ramesh Chowk during the evening shift.

Table 6

Weighted Decibel Levels (Lx)

Location	Weighted Decibel Levels (Lx)		
	Evening(5:05-5:55)		
	L_{10}	L_{50}	L_{90}
East bus station	85.7	77.2	67.5
West bus station	76.1	70.2	67.2
Ramesh Chowk	73.1	68.3	61.4
Hospital Chowk	75.5	65.7	59.5
Ghantaghar	66.1	59.7	55.8
New Vegetable Market	87.5	82.0	75.1

Padariya Chowk	65.2	60.7	54.1
Pashupati Aadarsh ma.bi	53.9	51.2	47.7
Radha Krishna Chowk	79.6	74.7	63.0
Bastipur	50.0	43.0	39.8
Bhadiya	54.5	52.7	50.4
Sankalpa Vidhyashram Pvt.Ltd	49.9	48.1	44.9
J S Murarka Multiple Campus	51.9	47.0	44.2
Choudhary Eye Hospital	48.8	47.0	44.9
Friends Model Hospital	71.4	64.7	58.7
Saptarishi Hospital	57.6	53.9	47.8
Lahan Cancer Care Center	55.4	52.1	43.5

Table 6 provides the Weighted Decibel Levels (Lx) at 10%, 50%, and 90% during the evening shift for 17 different locations. The data show that the Lx 10% level is highest at 87.5 dB at New Vegetable Market and lowest at 49.9 dB at Sankalpa Vidhyashram Pvt. Ltd. during the evening shift. For the Lx 50% level, the maximum is 82.0 dB at New Vegetable Market, while the minimum is 47.0 dB at JSMMC Lahan or Choudhary Eye Hospital during the evening shift. The Lx 90% level peaks at 75.1 dB at New Vegetable Market and drops to 39.8 dB at Bastipur during the evening shift.

Table 7

Equivalent Energy Level (Leq)

Place	Morning	Day	Evening
East bus station	72.42	87.77	87.77
West bus station	81.30	70.29	69.94
Ramesh Chowk	88.57	82.15	70.29
Hospital Chowk	65.05	77.27	70.70
Ghantaghar	65.95	66.76	61.08
New Vegetable Market	74.64	86.88	83.61
Padariya Chowk	68.03	70.50	62.38
Pashupati Aadarsh Ma.Bi	53.68	58.57	52.35
Radha Krishna Chowk	70.80	76.75	75.57
Bastipur	51.25	54.21	44.38
Bhadiya	54.48	55.32	53.98
Sankalpa Vidhyashram	72.48	69.60	50.31
JS Murarka Multiple Campus	62.52	62.66	46.30
Choudhary Eye Hospital	59.24	61.21	58.84
Friends Model Hospital	58.25	57.78	55.13
Saptarishi Hospital	56.55	57.78	54.01
Lahan Cancer Care Center	56.57	56.98	52.91

Table 7 shows the Equivalent Energy Levels (Leq) for morning, day, and evening shifts. The highest Leq values are 88.57 dB at Ramesh Chowk in the morning, and 87.77 dB at East Bus Station for both day and evening shifts. The lowest Leq values are 51.25 dB at Bastipur in the morning, 56.98 dB at Lahan Cancer Care Center during the day, and 52.9 dB at Lahan Cancer Care Center in the evening.

Table 8

Noise Pollution Level (L_{NP}) at

Place	Morning	Day	Evening
East bus station	94.90	119.17	105.97
West bus station	111.90	75.69	78.84
Ramesh Chowk	114.67	97.77	81.99
Hospital Chowk	77.95	96.77	86.7
Ghantaghar	90.15	78.26	71.38
New Vegetable Market	85.70	115.88	96.01
Padariya Chowk	82.13	77.90	73.48
Pashupati Aadarsh ma.bi	60.58	70.47	58.55
Radha Krishna Chowk	86.00	93.35	92.17
Bastipur	60.15	61.91	54.58
Bhadiya	62.98	68.62	58.08
Sankalpa Vidhyashram	90.58	93.6	55.31
J S Murarka Multiple Campus	72.92	75.46	54.00
Choudhary Eye Hospital	69.14	71.11	62.74
Friends Model Hospital	69.65	66.78	67.83
Saptarishi Hospital	67.75	74.18	63.81
Lahan Cancer Care Center	65.17	67.48	64.81

Table 8 presents the Noise Pollution Levels (LNP) for morning, day, and evening shifts. The maximum LNP values are 114.67 dB at Ramesh Chowk in the morning, 119.17 dB at East Bus Station during the day, and 105.97 dB at New Vegetable Market in the evening. The minimum LNP values are 60.15 dB at Bastipur in the morning, 61.91 dB at Bhadiya during the day, and 54.00 dB at JS Murarka Campus in the evening.

Table 9

Noise Climate (NC) and Traffic Noise Index (TNI)

Location	Morning (9:05-9:55)				Day (1:05-1:55)				Evening (5:05-5:55)			
	L_{10}	L_{90}	NC	TNI	L_{10}	L_{90}	NC	TNI	L_{10}	L_{90}	NC	TNI
East bus station	65.3	82.2	22.5	123	67.6	90.5	31.4	157.3	68.2	90.5	18.2	110.3
West bus station	67.6	90.5	30.6	154.1	67.2	70.8	5.4	57.6	67.2	70.8	8.9	72.8
Ramesh Chowk	71.9	96.0	26.1	144.3	74.6	86.0	15.7	103.5	62.9	71.6	11.7	78.2
Hospital Chowk	60.0	71.2	12.9	80.2	63.4	78.1	19.5	109.4	59.9	74.0	16.0	93.5
Ghantaghar	53.0	69.7	24.2	114.8	58.9	68.8	11.5	74.3	56.1	63.3	10.3	67.0

New Vegetable Market	67.1	75.7	11.12	81.38	67.6	90.2	29.0	147.8	78.3	86.9	12.4	94.7
Padariya Chowk	62.4	71.2	14.1	88.1	65.1	71.4	7.4	63.8	56.5	66.1	11.1	68.5
Pashupati Aadarsh ma.bi	46.6	53.2	6.9	43.9	52.3	59.2	11.9	65.2	48.1	52.7	6.2	42.5
Radha Krishna Chowk	64.7	72.9	15.2	95.4	68.7	80.2	16.6	100.4	65.5	77.3	16.6	99.4
Bastipur	45.8	52.9	8.9	51.1	47.9	54.4	7.7	48.7	40.2	46.0	10.2	50.6
Bhadiya	46.6	54.7	8.5	50.2	47.7	57.8	13.3	70.2	50.5	54.3	4.1	36.8
Sankalpa Vidhyashram Pvt. Ltd	56.3	72.4	18.1	98.3	61.3	69.7	24.0	115.6	45.6	49.5	5.0	34.9
JS Murarka Multiple Campus	55.9	64.0	10.4	66.0	56.4	63.7	12.8	73.2	45.0	49.8	7.7	45.0
Choudhary Eye Hospital	53.3	61.2	9.9	61.3	53.5	62.5	9.9	62.7	53.4	60.7	3.9	30.5
Friends Model Hospital	51.2	60.5	11.4	67.1	51.3	58.9	9.0	61.3	48.6	57.5	12.7	79.5
Saptarishi Hospital	51.9	58.6	11.2	64.4	50.7	57.3	16.4	83.1	48.1	59.0	9.8	57.0
Lahan Cancer Care Center	53.0	56.6	8.6	54.8	46.2	55.9	10.5	58.0	45.7	53.2	11.9	61.1

Table 9 presents the Noise Climate (NC) and Traffic Noise Index (TNI) for morning, day, and evening shifts across 17 locations in Lahan Municipality. The highest NC and TNI values during the morning shift are 30.6 dB and 154.1 dB, respectively, at West Bus Station. The lowest NC and TNI values in the morning shift are 6.9 dB and 43.9 dB, respectively, at Pashupati Aadarsh Ma. Bi. For the day shift, the maximum NC and TNI are 31.4 dB and 157.3 dB, respectively, at East Bus Station, while the minimum values are 7.4 dB at Padariya Chowk and 48.7 dB at Bastipur. In the evening shift, the highest NC and TNI are 18.2 dB and 110.3 dB, respectively, at East Bus Station, whereas the lowest values are 4.1 dB at Bhadiya and 34.9 dB at Sankalpa Vidhyashram Pvt. Ltd.

Data Analysis

Exceed weighted decibel

As concluding, weighted decibels (L_{10}, L_{50}, L_{90}) are exceed as (96.0 dB, 85.0 dB, 70.7 dB) in Traffic Area. Similarly, weighted decibels (L_{10}, L_{50}, L_{90}) are exceed as (75.8 dB, 68.0 dB, 64.2 dB) in Residential Area. Weighted decibels (L_{10}, L_{50}, L_{90}) are exceed as (74.0 dB, 67.7 dB, 58.7 dB) in Salient Area. Weighted decibels (L_{10}, L_{50}, L_{90}) are exceed as (90.8 dB, 82.0 dB, 75.1 dB) in Commercial Area of Lahan Municipality.

Exceed Equivalent sound Level

As concluding, Equivalent Sound Level (L_{eq}) are exceed in Traffic Area (87.77 dB in both day and evening shifts), Residential Area (70.50 dB in Day shift), Salient Area (72.48 dB in Morning shift) and Commercial Area (86.88 dB in Day shift) in Lahan Municipality.

Exceed Noise pollution Level

As concluding, Noise pollution Level (L_{NP}) are exceed in Traffic area (119.17 dB in Day shift), Residential area (82.13 dB in Morning shift), Salient Area (93.6 dB in day shift) and Commercial Area (115.88 dB in Day shift) in Lahan Municipality.

Exceed Noise climate

As concluding, Noise Climate (L_{NC}) are exceed in Traffic Area (31.4 dB in day shift), Residential Area (14.1 dB in Morning shift), Salient Area (24.0 dB in Day Shift) and Commercial Area (29.0 dB in Day shift) in Lahan Municipality.

Exceed Traffic Noise Index

As concluding, Traffic Noise Index (L_{TNI}) are exceed in Traffic Area (157.3 dB in Day Shift), Residential Area (88.1 dB in Morning shift), Salient Area (115.6 dB in Day Shift) and Commercial Area (147.8 dB in Day Shift) in Lahan Municipality.

Conclusion

Analysis wholly conclude that noise pollution in Lahan City threatens human health and economic stability. The local government has taken steps to mitigate this by creating alternative highways, establishing market zones, regulating vehicle registrations, and enforcing noise control policies. These efforts aim to make Lahan a model city in Purwanchal, crucial for regional connectivity and attracting visitors, including Indian patients at Chaudhary Eye Hospital. Current noise levels—such as an Equivalent Sound Pressure Level (Leq) of 86.88 dB, Noise Pollution Index (LNP) of 119.17 dB, Noise Climate (NC) of 31.4 dB, and Traffic Noise Index (TNI) of 157.3 dB—exceed safe limits. It is recommended to enhance market policies and protective measures to rescue the sensitive sites of Lahan city from sound pollution.

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