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Investigation and Abatement of Traffic Based Noise in Samba Town of Jammu and Kashmir, India

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Abstract:
Traffic noise is unwanted sound that comes from vehicles operating on roadways. During the study it was found that noise level of Samba town of Jammu and Kashmir, India is deteriorating at an alarming rate. Outdoor Equivalent Noise Level (L_{eq}), Noise Pollution Level (L_{NP}), Noise Climate (NC) and Traffic Noise Index (TNI) exhibited variable trends at different Subareas of both the first year as well as second year study period. Statistical analysis revealed significant ($p<0.05$ positive correlation($r>0$) between L_{eq} and traffic flow at all the subareas except at ATF1 and ATF7 (non-working hours).The value of TNI was found to be much more higher at all the subareas of study area than respective L_{eq} of study area. The noise levels were more than the prescribed and has reached an alarming level in most areas of the Samba town. So, it is high time to adopt effective mitigation measures to prevent the residents of Samba from the detrimental effects of this menace.

Keywords: Traffic Noise, Noise Climate, Noise Pollution, Menace.

INTRODUCTION

A world without sound can be imagined only with mixed feelings of fright and fun .But, the hellish conditions being created by the abuse of this beautiful gift of God by the unsound minds is a matter of grave concern not only for the present generation but also for the posterity. Noise pollution has become an unfortunate fact of life worldwide and man-made plague of the 21st century from which hardly anyone can abscond. The ever rising noise not only adversely affects the quality of life of human beings but has resulted in a bleak future for survival of other living organism as well.

Noise though being a pressing environmental problem in almost all urban areas has not been properly recognized. As a result, this problem is spreading its claws with every passing day resulting in further escalating this problem in both developing and developed countries and thus engulfing the whole world in its clutches. At present, noise pollution is considered as one of the key problems which has numerous detrimental effects on both physical and social environment

Dhole and Kadu (2018) while evaluating noise pollution in Washim town, Maharashtra also concluded that noise pollution was emerging as an environmental problem in Washim town and other parts of India. The people staying in noisy area especially above 70 dB(A) should take precautionary and protective measures in order to prevent themselves from noise induced hearing loss. The source of most outdoor noise (environmental noise) worldwide is mainly caused by machines and transportation systems and social events. Poor urban planning may give rise to noise pollution, since side-by-side industrial and residential buildings can result in noise pollution in the residential areas. Indoor noise can be caused by machines, building activities, and music performances, televisions etc.

The present work aims to understand and analyze the existing sources, extent and abatement of noise pollution **(Outdoor)** in Samba town of Jammu and Kashmir, India.

MATERIAL AND METHOD

The study area was divided into seven subareas so as to cover all potential noise pollution sources of Samba. The specific study area was categorized on the basis of traffic flow rates and average speed of vehicles.

To carry out noise monitoring, noise levels were recorded with the help of Digital Sound Level Meter (Data logger Model: 407764A) carried out at chest height. The slow response was selected at a weightage. The noise levels were recorded thrice a day i.e. Morning Period (0800-1000 hrs.), Noon Period (1200-1400 hrs.) and Evening Period (1800-2000 hrs.). During each sampling of noise, 20 readings of SPL (Sound Pressure Level) were recorded at an interval of 30 seconds in a period of 10 minutes. At the end of 10 minutes, minimum and maximum SPL (Sound Pressure Level) were recorded with the help of Sound Level Meter (Data logger model: 407764A).

From the observed readings of SPL (Sound Pressure Level), following Noise Indices were calculated:

(i) L_{eq} (Equivalent Noise Level)
(ii) L_{10} (The noise level that exceeded 10% of time)
(iii) L_{90} (The noise level that exceeded 90% of time)
(iv) Noise Climate (NC)
(v) Noise Pollution Level (L_{NP}) and
(vi) Traffic Noise Index (TNI)

Data of L_{eq}, NC, $L_{NP,}$ TNI, was compiled to calculate average values with standard deviation. All the values were represented in the form of histograms. Statistical analysis of data was carried out using **SPSS16 version**.

RESULTS AND DISCUSSION

The analysis of data of outdoor L_{eq} (Equivalent Noise Level) and NC (Noise Climate) at different Sub-Areas of study area revealed that the outdoor values exhibited variable trends at different Sub Areas during summer, winter and rainy season of both the first year as well as second year study period. The outdoor values of L_{NP} (Noise Pollution Level)and TNI also showed variable trends at different Sub Areas during different seasons of both first and second year. (Table 1-4). Also, the noise levels were more than the prescribed levels in all the Sub- areas and has reached an alarming level in most area of the Samba town. Vaiphei *et al.* (2016) while studying noise pollution levels of Allahabad found that the noise parameters were quite high and were above the standard limits laid down by the CPCB.

Table 1: Average Outdoor L_{eq} at different Sub-areas of study area (Samba Town of Jammu and Kashmir)

Sub - Areas	Outdoor L_{eq} dB(A) during					
	1st Year in Season			2nd Year in Season		
	Summer	Winter	Rainy	Summer	Winter	Rainy
ATF1	55.65±5.81 (45.6-62.3)	61.53±3.06 (60-65.3)	55.8±6.47 (49.6-66.9)	56±5.37 (46.3-62.3)	62.36±4.43 (57.3-66)	54.95±6.05 (47.3-63.5)
ATF2	76.16±9.59 (66-72.56)	74.67±5.20 (63.4-82.3)	73.74±3.81 (66.8-78.63	80.56±11.70 (61.64-92.33)	77.31±3.51 (70-81.3)	73.30±4.16 (66-73)
ATF3	86.24±6.26 (79.56-94.56)	84.46±3.83 (75.6-89.3)	81.75±3.95 (77.6-91.25	87.46± 5.80 (79.33-93.65	83.36±4.31 (76.5-89.6)	86.70±6.30 (77-92.33)
ATF4	85.69±7.48 (79.85-98.03)	72.75±4.03 66.61±78.88)	81.81±2.48 (74.1-84.6)	79.36±4.35 (70.78-83.36)	72.98±6.11 (66.61-85.66)	83.18±4.80 (73.2-86.2)
ATF5	86.81±6.34 (80-95.1)	80.81±1.73 (74.5-82.8)	82.19±5.96 (73.2-90.3)	87.63±5.24 (80.1-91.6)	83.11±4.90 (78.2-91.2)	81.33±3.62 (76.5-89.6)
ATF6	76.16±1.81 (73.6-77.656)	74.01±6.51 (66.61-78.88)	77.46±3.06 (74.1-80.1)	80.5±1.36 (79-82.3)	75.06±0.55 (64.39-76.66)	84.56±1.23 (88.3-88.6)
ATF7 (Working hrs,)	74.52±3.88 (72-79)	76.43±7.42 (72-85)	75.38±5.08 (69.52-78.63)	68.58±6.49 (61.09-72.63)	72.66±0.34 (72.6-73.1)	75.45±6.05 (68.46-79)
ATF7 (Non-working hrs.)	43 ±1 (42-44)	43±2 (41-45)	58±1.8 (56.2-59.1)	47±4.07 (42.3-49.5)	43.66±2.08 (42-46)	47.73±1.91 (43.2-44.3)

Table 2: Average Outdoor NC at different Sub-Areas of study area (Samba Town of Jammu and Kashmir)

Sub-Areas	Noise Climate (NC) dB(A) during					
	1st Year in Season			2nd Year in Season		
	Summer	Winter	Rainy	Summer	Winter	Rainy
ATF1	10.83±5.55 (5.3-17)	11.3±3.05 (5.3-15.2)	11.46±4.38 (3.9-17.7)	11.6±5.49 (1-18.1)	11.47±4.65 (5.3-15.1)	10.31±3.31 (5.3-12.5)
ATF2	10.21±2.33 (7-13)	6.87±1.86 (3.3-9.8)	16.73±4.89 (6.89-21.08)	9.57±7.44 (4.4-10.3)	9.22±3.79 (7-14)	16.71±4.88 (6.97-21.06)
ATF3	8.53±2.49 (6.7-13.3)	14.14±5.02 (2.7-19.1	25.07±7.38 (14.8-40))	11.13±3.84 (6.7-16)	14.45±2.06 (11.2-17.9)	28.33±11.19 (17.02-40)
ATF4	21.42±4.13 (16.31-29.33)	19.72±6.29 (15-23.34)	21.75±7.59 (9.8-28.3)	19.18±2.42 (15.67-20)	17.23±5.72 (6.67-23.33)	20.28±4.85 (10-24.7)
ATF5	21.27±6.55 (14.9-30.9)	17.64±2.47 (15-21)	16.72±5.63 (8.3-27.6)	22.27±5.96 (14.8-31)	19.33±5.45 (12-28.9)	19.26±3.84 (14.4-21.9)
ATF6	6.5±0.69 (5.6-7.3)	20.04±4.37 (15-22.78)	10.36±3.75 (8.1-14.7)	7.5±0.37 (7-7.9	15.633±0.8 (18.83-23.33)	13.6±2.08 (12.2-16)
ATF7 (Working hrs,)	17.57±0.36 (17.33-18)	17.20±6.23 (10-20.84)	14.1±7.62 (6.89-22.08)	19.35±4.16 (17-24.16)	19.41±0.14 (19.33-19.58)	8.9±0.7 (8.2-9.6)
ATF7 (Non-working hrs.)	5.33±0.57 (5-6)	5.66±2.30 (3-7)	9.67±0.29 (9.42-10).	9±0.1 (9)	6.2±1.92 (4-7.6)	5.93±1.22 (4.6-7)

Table 3: Average Outdoor Noise Pollution Level (L_{NP}) at different sub-Areas of study area (Samba Town of Jammu and Kashmir)

Sub Areas	L_{NP} dB(A) during					
	1st year in Season			2nd year in Season		
	Summer	Winter	Rainy	Summer	Winter	Rainy
ATF1	66.48±10.99 (45.6-77.3)	72.83±5.03 (61.8-78)	67.26±8.98 (54-80.1)	67.6±10.49 (47.3-79.4)	73.83±4.65 (62.6-79.5)	65.26±7.42 (56-76)
ATF2	86.37±11.09 (76.8-102.9)	81.54±5.26 (69.4-86.1))	90.47±4.49 (78.5-89.47)	90.13±16.30 (66.64-119.76)	86.53±5.34 (75.9-94.3)	90.01±4.35 (78.7±90.06)
ATF3	94.77±8.04 (86.26-107.86)	98.6±8.42 (78.3-105.7)	106.82±11.10 (94.4-131.25)	98.59±8.52 (88.2-109.65)	97.81±5.77 (90.7-105.5)	115.03±16.24 (95.66-131.66)
ATF4	107.11±10.8 (98.19-123.36)	92.47±6.68 (81.61-101.22)	103.56±9.55 (88.3-111.5)	98.54±6.36 (90.35-102.88	90.21±7.73 (79.35-99.99	103.46±8.02 (88.6-109.9)
ATF5	108.08±12.05 (96-116.2)	98.45±4.86 (90.2-102)114.	98.91±6.67 (89.5-108.2)	109.9±11.00 (95-122.2)	102.44±9.37 (94.3-120.1)	81.33±6.90 (81-116.6)
ATF6	82.66±2.48 (79.2-84.9)	94.05±6.51 (81.61-101.22)	87.82±6.4 (82.2-94.8)	88±1.72 (86-90.2)	90.69±0.45 (90.2-91.1	98.16±6.59 (93.8-106.3)
ATF7 (Working hrs,)	92.09±4.25 (89.4-97)	93.63±1.18 (92.84-95)	89.48±4.34 (79.38-88.01)	87.93±2.34 (85.25-89.53)	92.07±0.35 (91.66-92.34)	84..35±10.09 (81.97-101.08)
ATF7 (Non-working hrs.)	48.33±1.52 (47-50)	48.66±4.16 (44-52)	67.67±1.61 (66.2-69.4)	56±4.07 (51.3-58.5)	49.86±3.55 (46-53)	53.66±1.56 (48.2-51.3)

Table 4: Average Traffic Noise Index TNI at different Sub-Areas of study area (Samba Town of Jammu and Kashmir)

Sub Areas	TNI dB(A) during					
	1st year in Season			2nd year in Season		
	Summer	Winter	Rainy	Summer	Winter	Rainy
ATF1	58.94±21.70 (39.5-84.2)	68.55±58.25 (45.2-77.9)	64.32±16.9 (34.9-83.1)	64.76±21.31 (42.9-88.6)	70.00±58.25 (46.2-80.8)	59.7±12.63 (40.5-80.3)
ATF2	79.92±14.46 (63.3-104.3)	67.57±8.81 (54-79.7)	98.20±19.79 (57.76-118.32)	81.31±29.13 (49.3-148.3)	77.51±14.11 (63.9-98.3)	98.01±19.65 (59.21-116.23)
ATF3	83.82±11.87 (72.3-105.5))	99.56±18.27 (90.7-114.6)	109.97±20.91 (61-132)	93.71±14.90 (72.4-116.3)	99.6±9.25 (87.1-113.9)	116.88±34.95 (96.64-189.66)
ATF4	119.86±14.56 (96.07-141.32)	107.26±12.12 (85-123.34)	122.58±26.54 (96.4-163.1)	112.06±10.64 (94.01-125)	99.13±18.29 (68.34-123.32)	118.06±16.88 (82.9-131.5)
ATF5 Crossings	126.95±25.16 (101.2-160.9)	104.94±10.07 (93-119.8)	105.42±15.51 (78.8-132.7)	131.11±23.63 (100.5-161.2)	114.85±19.56 (92-152.5)	112.36±13.89 (96.80-119.9)
ATF6	67.66±4.03 (62.4-72.2	108.12±20.35 (85-23.34)	82.56±13.66 (72.4-98.1)	76.33±2.46 (73.9-79.9)	95.33±3.53 (93-99.4)	98.83±6.59 (93.8-106.3)
ATF7 (Working hrs,)	103.78±7.11 (99.8-112)	115.24±17.53 (95-125.38)	91.24±30.78 (57.76-118.32)	102.47±5.77 (99.33-109.14)	99.75±1.25 (98.2-100.62)	91.57±30.31 (59.21-119.32)

ATF7 (Non-working hrs.)	32±2.64 (30-35)	33.66±10.11 (22--40)	58.95±0.67 (58.26-59.6)	49±1 (48-50)	36.13±7.94 (27-41.4)	35.53±5.57 (29.4-40.3)

Overall analysis of outdoor noise levels at all the sub areas i.e. ATFI, ATF2, ATF3, ATF4 ATF5, ATF6 and ATF7 revealed maximum outdoor L_{eq} at ATF3 and least at ATF1. It was further observed that outdoor NC levels exhibited highest value at ATF4 and lowest value at ATF1. Also maximum outdoor Noise Pollution Level (L_{NP}) was exhibited at ATF3 and its minimum value was revealed in at ATF1. Similarly, the values of Traffic noise index (TNI) exhibited maximum value at ATF5 and minimum value at ATF1. Highest values of TNIat ATF5 was due to its location at Intersections /Crossings of Samba town predominated by maximum traffic flow and Commercial activities **(Figure 1).**

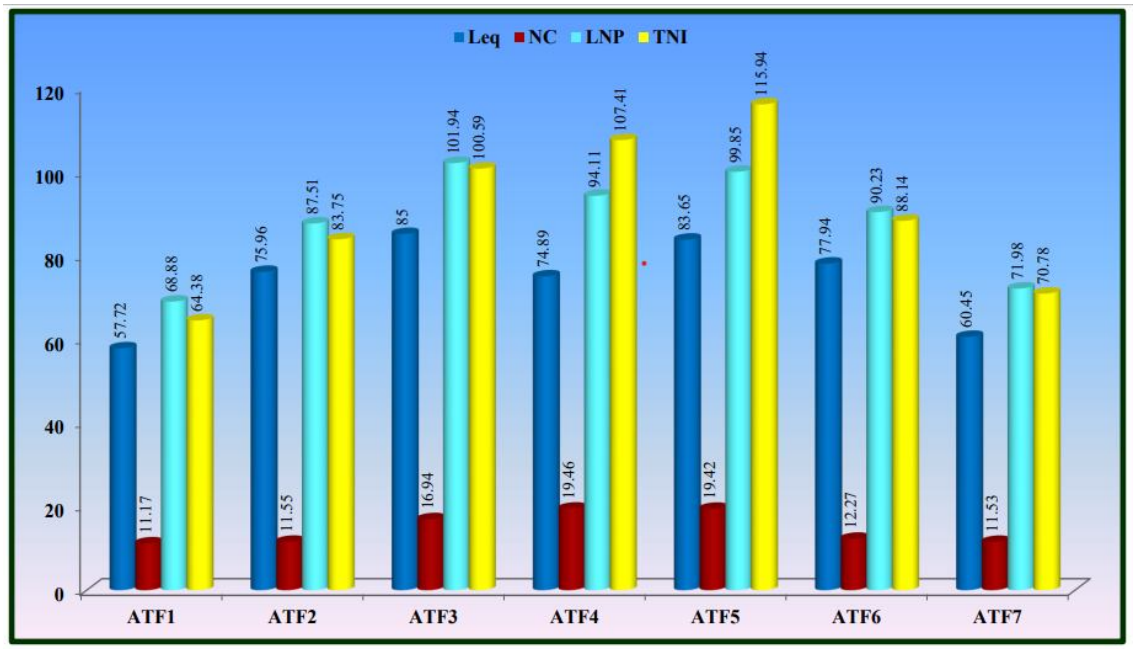

Figure 1: Average Outdoor Noise Levels at different Sub-Areas of Samba Town

Critical analysis of the data at different sub-areas of Samba Town revealed that the value of TNI was found to be much higher than the respective L_{eq} at all the Sub-Areas of study area (Fig. 1). Swain and Goswami (2013) also found the same results while comparing the values of TNI and L_{eq} and found higher values of TNI than respective L_{eq} at respective sites in Baripada town, India. This was because of more traffic volume, congested roads, poor road condition and poor traffic management. Islam and Kalita (2017) while studying the noise level of Guwahati city came to the conclusion of finding the city situation deteriorating because of exponential increase of vehicles, lack of parking space, narrow condition of roads and inappropriate traffic management. One of the major sources of augmented noise pollution at this Sub-Area was transportation mainly by road vehicles i.e., tempos and rickshaws, four wheelers, two wheelers and heavy vehicles etc. Ismail and Ahmed (2018) while studying noise pollution in Delhi concluded vehicular pollution as one of the most important causes of noise pollution and loud music as the second most important cause of noise pollution. The study further suggested awareness campaign involving citizens and strict and stringent enforcement of environment laws.

Overall statistical analysis of the data of traffic flow and L_{eq} revealed that except for ATF1 and ATF7 (non-working hours), all other Sub-Areas exhibited positive ($r>0$) significant ($P<0.05$) correlation between traffic flow and outdoor $L_{eq.}$ ATF1 though having less traffic flow with average traffic flow

rate of 271/hr and average speed of 27km/hr had comparatively more noise because of narrow , congested and damaged condition of roads and lane (Table 5).

Table 5: Correlation between Traffic Flow Rate and Outdoor L_{eq} at different subareas of Study Area

Sub-Areas	Correlation between Traffic Flow Rate and Outdoor L_{eq}						
		1st Year in Season			2nd Year in Season		
		Summer	Winter	Rainy	Summer	Winter	Rainy
ATF1	r	-0.65	-0.40	-0.39	-0.05	-0.99	-0.58
	p	0.1	0.94	0.85	0.90	0.80	0.2
ATF2	r	0.18	0.16	0.013	0.57	0.44	0.87
	p	7E-05	2E-05	3E-11	0.01	7E-05	2E-08
ATF3	r	0.43	0.28	0.82	0.88	0.26	0.72
	p	0.002	0.001	0.0002	0.03	0.01	0.0001
ATF4	r	0.47	0.30	0.51	0.86	0.57	0.46
	p	2E-05	0.01	0.05	0.001	0.003	0.02
ATF5	r	0.70	0.19	0.1	0.88	0.26	0.23
	p	0.002	0.03	0.01	0.02	0.02	0.04
ATF6	r	0.47	0.59	0.18	0.70	0.66	0.27
	p	0.01	0.01	0.001	0.01	0.001	0.003
ATF7 Working hours	r	0.18	0.16	0.22	-0.69	0.42	0.51
	p	7E-05	2E-05	2E-11	6E-06	2E-09	12E-02
ATF7 Non-working hours	r	0.1	-0.48	0.37	0.23	-0.99	0.41
	p	0.01	0.02	2E-09	5E-06	6E-06	12E-02

The negative ($r<0$) insignificant ($p>0.05$) correlation between and traffic flow and outdoor L_{eq} at ATF1 was because of plying of mostly scooters, auto-rickshaw, bikes etc. along these narrow lanes and by lanes which produced more noise. The negative ($r<0$) significant ($p<0.05$) correlation between traffic flow and outdoor L_{eq} during non-working hours at ATF7 was attributed to winds blowing during winter season which affected noise levels (Table 5).

CONCLUSION

From the overall analysis of the compiled data, it can be concluded that the noise level of Samba town is deteriorating at an alarming rate. Outdoor $L_{eq,}$ $L_{NP,}$ NC and TNI exhibited variable trends at different Sub -Areas of both the first year as well as second year study period. Statistical analysis revealed significant ($p<0.05$ positive correlation ($r>0$) between L_{eq} and traffic flow at all the subareas except at ATF1 and ATF7 (non-working hours).The value of TNI was found to be much more higher at all the subareas of study area than respective L_{eq} of study area .The noise levels were more than the prescribed and has reached an alarming level in most areas of the Samba town. So, it is high time to adopt effective mitigation measures to prevent the residents of Samba from the detrimental effects of this menace. There are different ways of controlling noise pollution right from at source, along its path and finally at target place but as far as Samba town is concerned following suggestions can prove beneficial if adopted with missionary zeal.

The first and the foremost step towards noise pollution control is to spread awareness among people regarding this silent killer and implement various management and mitigation measures to maintain the acceptable permissible noise levels like:

1. Outdated and ill maintained vehicles should be shunted out.
2. Proper Traffic Management to avoid jams and traffic congestion.

3. Pressure horns must be strictly banned in residential and silence zones.
4. Plantation of broad leaved trees and three tier plantation along roads, hospitals, educational institutions etc. should be encouraged which helps in noise reduction to a considerable extent.
5. Generators with silencers should be installed.
6. There should be strict and stringent enforcement of laws and various CPCB norms should be rigorously followed.

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