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Integration and comparison of assessment and modeling of road traffic noise in Baripada town, India

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Abstract
The road traffic is the predominant source of noise pollution in urban areas. Despite enactment of legislations and despite effort from Government level to abate vehicle noise, the noise exposure of people of India due to road traffic has hardly changed, but has increased day by day due to growth of vehicular population. Thus, an attempt had been made to assess the noise level in 12 different squares (major intersection points) of Baripada town during four different specified times (7-10 a.m., 11 a.m.-2 p.m., 3-6 p.m., 7-10 p.m.). The equivalent noise levels of all the 12 squares were found to be much beyond the permissible limit (70 dB during day time). Noise descriptors such as L_{10}, L_{50}, L_{90}, Leq, TNI (Traffic Noise Index), NPL (Noise Pollution Level) and NC (Noise climate) were assessed to reveal the extent of noise pollution due to heavy traffic in this town. It is pertinent to mention here that even the minimum Leq and NPL values were more than 70.9 dB and 88.4 dB, respectively. Chi-square (χ^2) test was also computed for investigated squares at different times to infer the level of significance. The test depicts that the noise levels of different squares do not differ significantly at the peak hour. The prediction model was used in the present study to predict equivalent noise levels. Comparison of predicted equivalent noise level with that of the actual measured data demonstrated that the model used for the prediction has the ability to calibrate the multi-component traffic noise and yield reliable results close to that by direct measurement. Episodic and impulsive noise levels by the air-horn of motor vehicles in Baripada were also appraised and were more than the permissible limit. Though, the dimension of the traffic generated noise pollution in Baripada was not so alaraming like other towns of India, a preliminary public health survey has also been carried out.

Keywords: Road traffic; Noise descriptors; Noise prediction; Community health survey; Baripada.

1. Introduction

Noise pollution is considered as one of the major factors affecting the quality of life in urban areas. This noise problem is mainly due to growing busy traffic. In Odisha, some studies on the traffic noise monitoring have been carried out at different cities like Jharsuguda [1], Balasore [2-4], Bhadrak [5, 6] and the average noise levels in these cities have been found to be more than the recommended value. Heavy traffic volumes, higher speeds, and greater number of trucks and buses in general and motor bikes in particular, improper stoppage of buses at locations rather than desired bus stoppage, improper parking of four wheelers along the road create enormous noise. On continuation with the study of [2-5]; a similar

attempt has been made in this study to record the road traffic noise levels at 12 different squares (major intersection points) to assess the extent of vehicular noise pollution around the Baripada town.
Noise descriptors such as L_{10}, L_{50}, L_{90}, Leq, TNI (Traffic Noise Index), NPL (Noise Pollution Level) and NC (Noise climate) were assessed to reveal the extent of noise pollution in this town. As there is no defined basic noise levels on the roads prescribed by Central Pollution Control Board (CPCB), India; the detected noise levels of this town in day time were compared with tolerance limit on roads (traffic noise) during day-time 70 dB (A) prescribed by WHO [7]. Moreover, the prediction model is used to predict the equivalent noise level. These predicted simulated values were compared with the actual measured data.

2. Materials and methods

Baripada town is located at 21° 94′ North Latitude and 86° 72′ East Longitude in the district of Mayurbhanj, largest in the state Odisha. The noise levels were measured following standard procedure using calibrated sound level (dB) meter from September to December, 2011 at twelve important and crowded squares (road sections) of Baripada (Badabazar square, Bus-stand, Station bazar square, Lal bazar square, Murgabadi square, Bhonjpur square, Cinema square, Palbani golei square, Kacheri square, Hospital road, KMBM road square, Takatpur square) [8, 9]. Sixty measurements were made within one hour duration (i.e. at one minute interval) during four specified times (7-10 a.m., 11 a.m.-2 p.m., 3-6 p.m. and 7-10 p.m.). The noise monitoring was done in a good climatic condition, where there was no sign for cloud. Also the monitoring was done in all working days excluding Sunday and local holidays in order to get good result.
The noise levels of different squares in different time intervals were assessed along with their equivalent noise levels (L_{eq}). L_{eq} represents the equivalent energy sound level of a steady state and invariable sound. It includes both intensity and length of all sounds occurring during a given period [10, 11]. Noise descriptors such as L_{10}, L_{50}, L_{90} were also assessed to calculate the value of L_{eq} using the formula, $L_{eq} = L_{50} + (L_{10}-L_{90})^2 / 56$ [12]. As L_{eq} is an insufficient descriptor of the annoyance caused by fluctuating noise, Noise Pollution Level (NPL) expressed in dB is also calculated by using the formula [$NPL = L_{eq} + a (L_{10}-L_{90})$, where, a = 1.0 (constant in the equation)]. NPL takes into account the variations in the sound signal and hence serves as better indicator of the pollution in the environment for physiological and psychological disturbance of the human system. Noise Climate (NC) is the range over which the sound levels are fluctuating in an interval of time and is assessed using the formula ($NC = L_{10}-L_{90}$). Traffic Noise Index (TNI) is another parameter, which indicates the degree of variation in a traffic flow. This is also expressed in dB (A) and can be computed using the relation [$TNI = 4 (L_{10}-L_{90}) + L_{90} – 30$ dB (A)]. Traffic volume is defined as the total number of vehicles flowing per hour. The number of vehicles passing through a fixed point on the road was counted. The ratio of heavy trucks and buses to total traffic is called truck traffic mix ratio. This was computed in terms of percentage. An increase in this ratio will increase the noise level.
The prediction of noise level was computed by using the model of Griffiths and Langdon [13], i.e.,

$$Leq = L_{50} + 0.018 (L_{10} – L_{90})^2 \quad (1)$$

where, the statistical percentile indicator were calculated with the following formulas:

$L_{10} = 61 + 8.4 \text{ Log } (Q) + 0.15P – 11.5 \text{ Log } (d)$
$L_{50} = 44.8 + 10.8 \text{ Log } (Q) + 0.12P – 9.6 \text{ Log } (d)$
$L_{90} = 39.1 + 10.5 \text{ Log } (Q) + 0.06P – 9.3 \text{ Log } (d)$;

where, ‘Q’ is the vehicles flow, ‘P’ is the percentage of heavy vehicles and ‘d’ is the distance (7 m in this study) of source receiver.
The analysis of the measured noise levels generally depicts that there are existence of variations of noise with variables as the time of day, and road way types etc. In order to determine the existence and statistical significance of these variations and trends, a cross classification analysis along with chi-square (χ^2) test was assessed on the data.
This test was also used to test how well a set of observations fit a given distribution. It therefore, provided a test of goodness of fit. To test the significance of discrepancy between observed and calculated noise levels, χ^2-test of goodness of fit was applied. It enables us to know whether deviation of measured from calculated values is not by chance but due to inadequacy of the theory to fit measured data.
A sample of public (351) was interviewed using a questionnaire to delineate the perception about the noise and its significance on health of community. The questionnaire consisted of general information about the purpose of the public health survey, i.e., collection of health-related data in order to improve

health-care planning and prevention [14], nowhere stating that traffic noise pollution specifically would be studied [15].

3. Results and discussion

It was clearly observed that the main contributor of noise in this town was vehicular traffic. Noise pollution was assessed and analyzed in 12 different specific traffic squares of the town (Table 1) in four different times (7-10 a.m., 11 a.m.-2 p.m., 3-6 p.m. and 7-10 p.m.). The noise levels of such twelve road sections ranged from 55.7 to 107.2; 55.4 to 109.3; 56.1 to 108.3; 55.6 to 107.6; 54.1 to 108.4; 55.1 to 107.7; 56.3 to 109.6; 56.1 to 106.7; 56.4 to 108.7; 55.4 to 109.9; 57 to 106.7; 57.3 to 106.1 dB, respectively (Table 1). L_{10} values of all 12 monitored sites ranged from 77.4 to 80.9 dB; 77.7 to 82.1 dB; 78.7 to 81.9 dB; 80.8 to 84.7 dB during 7-10 a.m., 11 a.m.-2 p.m., 3-6 p.m. and 7-10 p.m., respectively (Table 1). Similarly, L_{50} and L_{90} values of all 12 monitored sites varied from 65.5 to 68.4 dB and 59.6 to 61.5 dB; 66.1 to 69.5 dB and 59.4 to 62.1 dB; 68.3 to 69.6 dB and 60.4 to 63.4 dB; 70.3 to 73.6 dB and 62.2 to 66.8 dB during 7-10 a.m., 11 a.m.-2 p.m., 3-6 p.m. and 7-10 p.m., respectively (Table 1). Accordingly, the calculated Leq (equivalent noise levels) values ranged from 70.9 to 74.7 dB; 71.8 to 76.9 dB; 73.2 to 75.9 dB; 76.8 to 80.4 dB during 7-10 a.m., 11 a.m.-2 p.m., 3-6 p.m. and 7-10 p.m., respectively (Table 1). NPL values of all 12 monitored sites ranged from 88.4 to 93.7; 88.8 to 93.7; 89.7 to 96.3 and 94.9 to 101.9 dB during 7-10 a.m., 11 a.m.-2 p.m., 3-6 p.m., and 7-10 p.m., respectively (Table 2). TNI values ranged from 100.9 to 112.1; 98 to 117.2; 98.2 to 112.9 and 105.3 to 118.2 dB during 7-10 a.m., 11 a.m.-2 p.m., 3-6 p.m., and 7-10 p.m., respectively (Table 2). Even the minimum Leq values were more than 70.9 dB and even minimum NPL values were more than 88.4 dB. Similarly, minimum TNI value was 98 dB. These high and distressing values of Leq, Noise Pollution Level (NPL) and Traffic Noise Index (TNI) clearly demonstrated that the dimension of the traffic generated noise pollution in Baripada has become a concern of worry. It was also observed that at some locations the characteristics of noise caused by fast moving traffic, different from those caused by congested or slow moving traffic. Noise from congested traffic was found to contain occasional peaks and vary more in levels. A systematic comparison between TNI and Leq noise levels for all 12 selected locations revealed that the TNI values were much more than respective Leq levels (Tables 1, 2). Similarly, NC values ranged from 16.8 to 20.4; 15.9 to 21.7; 16.5 to 20.4 and 17.5 to 21.5 dB during 7-10 a.m., 11 a.m.-2 p.m., 3-6 p.m. and 7-10 p.m., respectively (Table 2). NC is otherwise known as the difference between peak (L_{10}) and background (L_{90}) noise. The values of TNI and NC simply demonstrated that although the noise levels during any period of the day were generally constant but the presence of single– event noise was sufficient to affect the values of different noise percentile levels and consequently the TNI and NC. This is due to overpopulated road ways with bad conditions, broken roads and minimal traffic management [16].

All these values of noise descriptors clearly showed high noise levels in Baripada town mostly throughout the day in general and during the evening (7-10 p.m.) in particular. The calculated χ^2 values are 1.597; 3.726; 4.715 and 9.644 for different time intervals such as 7-10 a.m., 11 a.m.-2 p.m., 3-6 p.m. and 7 p.m.-10 p.m., respectively.

But $\chi^2_{tabulated}$ at 99% level of significance at 11 degrees of freedom = 3.053

$\chi^2_{tabulated}$ at 95% level of significance at 11 degrees of freedom = 4.575

$\chi^2_{tabulated}$ at 5% level of significance at 11 degrees of freedom = 19.675

$\chi^2_{tabulated}$ at 5% level of significance at 11 degrees of freedom = 24.725

Since our χ^2 value during 7 a.m.-10 a.m. is too small than tabulated χ^2 value, therefore $L_{calculated}$ and $L_{observed}$ values are in good agreement at 11 degrees of freedom and at 99 %, 95 %, 5 % and 1 % significance level while the χ^2 values during 11 a.m.-2 p.m., 3 p.m.-6 p.m. and 7 p.m.-10 p.m. are significant at 5 % and 1 % significance level.

Table 3 depicted the prediction of noise pollution levels at different squares of Baripada by using the model of Griffiths and Langdon [13]. It is observed that the value of assessed predicted noise level is close to respective actual equivalent noise level measured (Table 3). Such comparison depicted that the model used for the prediction in the present study has the ability to calibrate the multi-component traffic noise and yield reliable results close to that by direct measurement. The Co-relation (R2) value for observed Leq versus calculated Leq for the present model is 0.281, -0.09, 0.302 and -0.285 for different time intervals of the aforesaid squares. Using the given data, a calibrated model has been checked for validation by R^2 value and χ^2 test, which have given good results. Hence, this calibrated model can be used for noise prediction for Indian conditions.

Table 1. Noise level (dB) variations at different squares of Baripada town at different time intervals

Name of the square	7 a.m. - 10 a.m.							11 a.m. – 2 p.m.							3 p.m. – 6 p.m.							7 p.m.- 10 p.m.						
	Min	Max	Mean ± SD	L10	L50	L90	Leq	Min	Max	Mean ± SD	L10	L50	L90	Leq	Min	Max	Mean ± SD	L10	L50	L90	Leq	Min	Max	Mean ± SD	L10	L50	L90	Leq
Badabazar square	55.7	104.8	76.4±7.7	79.3	68.4	60.4	74.7	57.5	105.6	76.8±7.7	80.4	68.6	61.6	74.9	58.6	106.5	78.5± 8.0	81.4	68.5	61.7	75.4	59.7	107.2	79.1±8.7	82.5	70.3	63.4	76.8
Busstand square	55.4	106.2	74.6±7.6	77.4	67.5	60.6	72.5	56.1	108.6	79.5± .7	82.1	68.5	60.4	76.9	56.4	103.4	79.5± 8.3	80.6	68.3	60.5	75.5	58.2	109.3	80.2±9.0	82.4	70.5	63.5	76.8
Station bazar square	56.1	104.3	76.7±7.6	79.6	67.6	60.5	74.1	56.3	105.7	78.3± 7.3	81.2	67.5	60.2	75.3	58.2	101.6	78.4 ±8.2	81.4	68.4	61.6	75.4	59.1	108.3	79.6±8.8	83.7	72.2	62.2	80.4
Lalbazar square	56.3	100.8	75± 8.1	79	65.5	61.5	70.9	55.6	104.3	76.7± 8.0	79.4	66.1	61.5	71.8	57.6	102.5	76.7± 8.3	81.5	68.4	61.4	75.6	61.1	107.6	78.8±8.0	82.1	71.3	64.2	77
Murgabadi square	54.1	105.2	75.8+8.5	79.3	66.3	60.6	72.5	54.3	106.8	76.3±8.6	79.9	67.1	60.3	73.9	55.5	103.4	77.1± 9.0	80.7	68.4	61.1	75.2	59.7	108.4	78.7± 8.3	81.3	71.5	62.5	77.8
Bhonjpur square	55.1	106.2	74.3+8.4	80.9	66.5	60.5	73.9	56.4	107.7	75.4± 8.2	78.4	68.2	59.4	74.6	57.3	101.2	76.4± 8.1	81.7	68.5	61.3	75.9	60.5	102.3	77.6±8.1	82.7	72.3	64.5	78.2
Cinema square	56.3	101.4	73.8+8.7	78.2	67.4	59.6	73.5	56.6	99.4	73.8±8.8	79.8	67.6	59.4	75	59.4	106.4	76.4 ±8.9	81.9	68.3	62.6	74.9	60.3	109.6	78.7±8.6	83.7	71.2	64.5	77.7
Palbani golei square	57.2	106.7	74.3+8.6	78.7	68.1	59.6	74.6	57.6	105.4	74.5±8.0	78.2	67.3	61.6	72.2	56.1	104.4	77.2± 7.3	81.7	68.5	63.4	74.4	60.4	106.2	77.6±8.0	82.8	73.4	65.3	78.8
Kacheri square	57.6	108.2	74.4+7.9	77.8	67.3	60.1	72.8	57.2	106.3	75.1±8.9	79.7	66.4	60.6	72.9	56.4	99.3	76 ±8.7	80.4	68.4	60.4	75.5	59.7	108.7	76.9±9.7	80.8	73.6	62.6	79.5
Hospital road	55.4	106.6	73.8+8.5	79	66.3	59.8	72.8	56.5	108.4	73.9±8.1	77.7	69.5	61.1	74.4	57.2	101.6	75.8± 7.2	78.7	68.4	62.2	73.2	60.6	109.9	77.7±7.7	81.7	71.5	63.4	77.4
KMBM square	58.3	101.7	72.5+7.4	79.2	67	60.6	73.1	57.3	98.5	75.9±6.7	79	67.3	59.8	73.8	57	103.6	75.9 ±7.6	79.1	69.3	61.5	74.8	60.8	106.7	78.4±9.1	82.7	72.4	63.6	78.9
Takatpur square	59.5	105.1	73.4+7.1	79.5	66.5	61.5	72.2	58.7	102.6	75.8±8.2	78	68.6	62.1	73.1	57.3	104.9	76.1± 7.7	79.7	69.6	62.5	74.8	62.3	106.1	78.7±8.1	84.7	72.5	66.8	78.2

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Table 2. Noise descriptors (TNI, NPL, NC) variations at different squares of Baripada town at different time intervals

Monitoring Sites	7 a.m. - 10 a.m.			11 a.m. – 2 p.m.			3 p.m. – 6 p.m.			7 p.m.- 10 p.m.		
	TNI	NPL	NC	TNI	NPL	NC	TNI	NPL	NC	TNI	NPL	NC
Badabazar square	106	93.6	18.9	106.8	93.7	18.8	110.5	95.1	19.7	109.8	95.9	19.1
Busstand square	107.8	89.3	16.8	117.2	98.6	21.7	110.9	95.6	20.1	109.1	95.7	18.9
Stationbazar square	106.9	93.2	19.1	114.2	96.3	21	110.8	95.2	19.8	118.2	101.9	21.5
Lalbazar square	101.5	88.4	17.5	103.1	89.7	17.9	111.8	95.7	20.1	105.8	94.9	17.9
Murgabadi square	105.4	91.2	18.7	108.7	93.5	19.6	109.5	94.5	19.6	107.7	96.6	18.8
Bhonjpur square	112.1	94.3	20.4	105.4	93.6	19	112.9	96.3	20.4	107.3	96.4	18.2
Cinema square	104	92.1	18.6	111	95.4	20.4	109.8	94.2	19.3	111.3	96.9	19.2
Palbani golei square	106	93.7	19.1	98	88.8	16.6	106.6	92.7	18.3	105.3	96.3	17.5
Kacheri square	100.9	90.5	17.7	107	92	19.1	110.4	95.5	20	105.4	97.7	18.2
Hospital road	106.6	92	19.2	97.5	91	16.6	98.2	89.7	16.5	106.6	95.7	18.3
KMBM square	105	91.7	18.6	106.6	93	19.2	101.9	92.4	17.6	110	98	19.1
Takatpur square	103.5	90.3	18	95.7	89	15.9	101.3	92	17.2	108.4	96.1	17.9

Increasing population of Baripada township in different census clearly demonstrated a sure increase in vehicular growth of the town. A comparative data on the number of different types of vehicles passes through the studied traffic squares in a day is given in the Table 4. Maximum number of total vehicles passing in a day (from 7 a.m. to 10 p.m.) was observed at Bada bazar square (7387) followed by Kacheri square (6818) and Bus-stand square (6551), whereas minimum number of total vehicles passing in unit time was observed at Palbani golei square (5742), Murgabadi square (6261) and Cinema square (6315). The peak traffic was observed during two specified times such as 7-10 a.m. and 7-10 p.m. at all the monitoring squares of the town. Maximum numbers of people are traveling during the morning and evening time for office work and schools having similar working hours. Trucks and buses are contributing more noise to the environment, than compared to automobiles. It is evident that, besides the total noise level, the number of heavy vehicles will be an important parameter in the annoyance function. The percentage of heavy trucks and buses to total traffic was calculated to work out truck traffic mix ratio (P) (Table 5). Similarly, truck traffic mix ratio (P) was maximum i.e. 2.55 during 7-10 p.m. and 2.46 during 3-6 p.m. at Cinema and Kacheri square, respectively and followed by 2.43 during 7-10 p.m. at Palbani golei square and Hospital road square. These data revealed that an increase in this ratio increased the noise level.

Excessive noise can lead to mental and physical health problems such as headache, bad temper, hearing problem, loss of concentration, aural communication disturbances etc. [17-20]. Non-auditory physical health effects in general and annoyance from noise exposure in particular include changes in blood pressure, heart rate, and levels of stress hormones and cardiovascular changes [15, 21-24]. Thus to know the health effects of noise in this town, the noise perception survey was carried out by a questionnaire. It was administered to 351 individuals in Baripada. This survey clearly demonstrated that 56 % respondents were not satisfied about the noise level at Baripada. Among the sources of environmental noise, the most important was road traffic noise, with 51 % of the respondents describing it as the noise they would most like to get rid of. The study also revealed that 41 % of interviewees were highly annoyed by the noise produced from different vehicles. Amongst them, majority of the respondents (36%) were irritated with the air-horn noise from motor cycle. 14% of respondents told that they have had at least one experience of being temporarily "deafened" by loud noise. This sort of partial hearing loss is called Temporary Threshold Shift (TTS). If anybody suffers frequently TTS, he may suffer complete hearing loss. 34 % respondents identified headache as the main health effect of noise pollution. 24% interviewees were feeling mental stress, 8% were suffering from insomnia and 0.1% respondents were suffering from hearing loss. 11% of people shared their sleep disturbance due to traffic noise during night-time.

Table 3. Prediction of noise level of different squares of Baripada town

	7a.m.-10a.m.		11 a.m. – 2 p.m.		3 p.m. – 6 p.m.		7 p.m.- 10 p.m.	
	Predicted Noise level	Actual Leq measured	Predicted Noise level	Actual Leq measured	Predicted Noise level	Actual Leq measured	Predicted Noise level	Actual Leq measured
Badabazar square	70.8	74.7	69.6	74.9	69.8	75.4	72	76.8
Busstand square	70.3	72.5	69.7	76.9	69.8	75.5	70.5	76.8
Stationbazar square	70.2	74.1	69.6	75.3	69.5	75.4	70.5	80.4
Lalbazar square	70.4	70.9	69.6	71.8	69.7	75.6	71.1	77
Murgabadi square	70.2	72.5	69.8	73.9	70.1	75.2	70.2	77.8
Bhonjpur square	70.4	73.9	69.5	74.6	69.9	75.9	70.5	78.2
Cinema square	70.2	73.5	69.6	75	70.1	74.9	70.5	77.7
Palbani golei square	70.1	74.6	69.5	72.2	69.7	74.4	69.3	78.8
Kacheri square	70.2	72.8	70.3	72.9	70.5	75.5	71.0	79.5
Hospital road	70.1	72.8	69.5	74.4	69.6	73.2	71.2	77.4
KMBM square	70.1	73.1	69.4	73.8	69.7	74.8	71.1	78.9
Takatpur square	69.9	72.2	69.5	73.1	69.8	74.8	70.8	78.2

Table 4. Total number of vehicles passing the road in unit time at different times of a day in and around Baripada town

Monitoring sites	Number of vehicles that passed in a day																Grand Total
	7 a.m. - 10 a.m.				11 a.m. – 2 p.m.				3 p.m. – 6 p.m.				7 p.m.- 10 p.m.				
	2 & 3 W	LMV	HMV	Total	2 & 3 W	LMV	HMV	Total	2 & 3 W	LMV	HMV	Total	2 & 3 W	LMV	HMV	Total	
Badabazar square	1744	112	19	1875	1302	116	22	1440	1344	124	23	1491	2383	157	41	2581	7387
Busstand square	1596	126	19	1741	1335	120	18	1473	1396	132	23	1551	1602	146	38	1786	6551
Stationbazar square	1557	128	19	1704	1338	109	17	1464	1349	117	19	1485	1538	135	40	1713	6366
Lalbazar square	1596	118	32	1746	1286	116	26	1428	1338	122	16	1476	1640	147	36	1823	6473
Murgabadi square	1448	114	31	1593	1346	129	28	1503	1413	128	28	1569	1421	141	34	1596	6261
Bhonjpur square	1512	127	35	1674	1343	117	19	1479	1403	118	30	1551	1613	137	38	1788	6492
Cinema square	1511	119	32	1662	1322	109	21	1452	1370	124	24	1518	1494	146	43	1683	6315
Palbani golei square	1421	122	29	1572	1275	114	27	1416	1357	119	27	1503	1092	114	45	1251	5742
Kacheri square	1496	134	32	1663	1407	106	32	1545	1513	114	41	1668	1761	135	45	1942	6818
Hospital road	1534	108	17	1659	1207	112	16	1335	1341	118	14	1473	1839	128	49	2016	6483
KMBM square	1484	114	22	1620	1244	109	18	1371	1346	123	19	1488	1785	142	44	1971	6450
Takatpur square	1446	121	20	1587	1277	115	24	1416	1349	118	24	1491	1662	136	38	1836	6330

2 & 3 W: Two and Three Wheelers; **LMV**: Light Motor Vehicles; **HMV**: Heavy Motor Vehicles

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Table 5. Q (Traffic Volume) and P (Truck-Traffic Mix Ratio) at different squares of Baripada town at different time intervals

Monitoring Sites	7 a.m. - 10 a.m.		11 a.m. – 2 p.m.		3 p.m. – 6 p.m.		7 p.m.- 10 p.m.	
	Q	P (%)	Q	P (%)	Q	P (%)	Q	P (%)
Badabazar square	625	1.01	480	2.68	497	1.54	860	1.59
Busstand square	580	1.1	491	2.69	517	1.48	595	2.13
Stationbazar square	568	1.11	488	2.69	495	1.28	571	2.25
Lalbazar square	582	1.83	476	2.68	492	1.08	607	1.98
Murgabadi square	531	1.94	501	2.7	523	1.78	532	1.91
Bhonjpur square	558	2.1	493	2.69	517	1.93	596	2.12
Cinema square	554	1.92	484	2.68	506	1.58	561	2.55
Palbani golei square	524	1.84	472	2.67	501	1.79	417	2.43
Kacheri square	554	1.92	515	2.71	556	2.46	647	2.32
Hospital road	553	1.02	445	2.65	491	.95	672	2.43
KMBM square	540	1.36	457	2.66	496	1.28	657	2.23
Takatpur square	529	1.26	472	2.67	497	1.61	612	2.1

4. Conclusion

It is inferred that the detected noise levels of this town were more than the respective tolerance limit on roads (traffic noise) during day (70 dB A) time (W.H.O., 1999). It is obvious that detected noise is a very high level, corresponding to the day time limit recommended by the WHO for urban centers (55dB). Traffic noise affects the ability to work, learn, rest, relax, sleep, etc. Thus, there should be ban of hydraulic horn and banning very old vehicles [25]. New highways and over bridges must be built at appropriate places to abate congestion of traffic. Public awareness programmes should be conducted at all levels to educate people regarding the health affects due to prolonged noise exposure. The Baripada Administration needs careful attention for abating road traffic noise through modification of traffic flow and also by sustainable traffic management.

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