

Assessment of Vehicular Noise Pollution at Different Squares in Jabalpur City, MP (India)

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Abstract - The present study was carried out to assess the noise level from vehicular traffic in Jabalpur city during different portion of day i.e. morning, afternoon and evening. This has been determined by collecting the noise level samples from different squares of Jabalpur city. The sampling locations are as follows:

1. Shastri Bridge Square
2. Ranitaal square
3. Damoh Naka square
4. Collectorate Square.

The noise level samples were analysed for various parameters of noise during different portion of day i.e. morning, afternoon and evening. The different noise descriptors like percentile exceeded sound level (L_x), equivalent continuous sound level (L_{eq}), Traffic noise index (TNI), noise pollution level (NPL) and noise climate (NC) were further analysed.

Key Words: Noise, Morning, Evening, Afternoon, Squares

1. INTRODUCTION

Presence of one or more sounds at different pressure levels and for different duration such that it starts affecting the life in the biosphere is termed as noise pollution. According to the report given by the World Health Organization ((WHO), 2005) the third most hazardous type of pollution is noise pollution. It is a weightless form of pollution which interferes in day-to-day communication and disrupts our health. The study examines the problem of noise pollution from one of the major source i.e. automobiles. An attempt was made to measure and analyze various noise levels emanating from vehicles on selected squares in Jabalpur city.

1.1 Effects of Noise Pollution

Prolonged exposure to certain noise level can have detrimental effect on human beings and animals. Some of the effects of noise pollution on human beings are as follows:-

- Noise – induced hearing impairment ;
- Interference with speech communication ;
- Disturbance of rest and sleep ;
- Mental – health and performance effects ;
- Interference with intended activities;

1.2 Vehicular Noise Pollution

With growth and urbanization of our cities and towns, there has been a rapid increase in the traffic volume on the roadways. Although transportation is an indispensable part of the modern society, its benefits may be overshadowed by its negativities and is a cause for concern for the community. Noise pollution from road traffic streams is one such negative consequence. Individual vehicle noise is a combination of noises produced by:

- the engine
- The horn
- The interaction of tyres and road pavement
- Exhaust noise
- Brake squeal

2. NOISE LEVEL PARAMETERS

L_{eq} , L_{10} , L_{50} and L_{90} are considered as basic parameter and all other parameter like TNI, LNP and NC can determined on the basis there value.

2.1 Equivalent (A Weighted) Sound level (L_{eq})-

This is the steady noise which in the measurement period would carry the same energy as is extended by fluctuating level over the same time.

$$L_{eq} = 10 \log \sum_{i=1}^{i=n} 10^{\frac{L_i}{10}} \times t_i$$

Where,

n = total number of sound samples

L_i = noise level of any ith sample

t_i =time duration of ith sample expressed as fraction of total time sample

2.2 Percentile exceeded sound Level (L_x) decibel-

The noise level exceeded for x per cent of the time is denoted by L_x . The most common noise exceeded level used is L_{10} i.e. noise level exceeding for 10 per cent of time. It is an indication of the peak level of the intruding noise, where as L_{90} level is an indicator of the background noise level. L_{50} is median value of different sound levels.

2.3 Traffic Noise Index (TNI)-

The traffic noise index is a method used to estimate annoyance responses due to traffic noise. The value of TNI over 74 dB (A) (Scholes and Sargent, 1971, Ma et al., 2006) is defined as the threshold of over criterion. It is computed using the following formula (Langdon and Scholes, 1968):

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

2.4 Noise Pollution level (LNP)-

It is found that Leq on an energy basis is not sufficient to describe the degree of annoyance caused by fluctuating noise. A new parameter noise pollution level was developed by Robinson in the late 60's (Schultz, 1972) and has a threshold value of 72 dB (A) (Scholes and Sargent, 1971). At times to describe community noise, which employs the equivalent continuous (A-weighted) sound level and the magnitude of the time fluctuations in levels, Noise Pollution Level (LNP) is used. The measurement is conceived so that it combines degree of steadiness in time of the noise (assuming that the less steady it is, the more distracting and annoying it becomes).

$$LNP = L_{50} + (L_{10} - L_{90})^2 / 60 + (L_{10} - L_{90})$$

2.5 Noise Climate (NC)-

Sound levels will be fluctuating over an interval of time. The range over which the fluctuations occur is known as Noise Climate (NC) and is assessed by the following formula.

$$NC = (L_{10} - L_{90})$$

3. MATERIALS AND METHODOLOGY

In the present study an Environmental sound level meter. (Envirotech SLM 100, Sound Level Meter, Type 2 dBA) is used. It is used to measure the existing noise equivalent level (Leq) dB (A) at the various intersections (locations). The instrument was kept almost to chest level (1.2m) in order to reduce errors due to reflection of sound from the body of investigator and the instrument was kept at 5m away from the roadside during sampling. The noise monitoring was done on working days i.e. excluding Sunday and local holidays in good climatic conditions in order to get consistent results. All the readings were taken from 21st to 29th November 2017.

For analysis whole portion of day time is divided into morning, afternoon and evening with respect to different time duration. These classifications are done as follows:

- MORNING-6AM TO 12AM
- AFTERNOON-12AM TO 6PM
- EVENING-6PM TO 10PM

Furthermore, the different noise descriptors like percentile exceeded sound level (Lx), equivalent continuous sound level (Leq), and Traffic noise index (TNI) and noise pollution level (NPL) were determined for morning, afternoon and evening time period to analyse different aspect noise pollution.

4. RESULT AND DISCUSSION

Average for all the noise parameters is taken as the representation of noise level parameter of Jabalpur city as a whole. In such analysis it is found that afternoon time has maximum value of Leq i.e. 86.2 dB. Further whole analysis is done under morning, evening and afternoon time durations.

4.1 MORNING

Study time between 6 am to 12 am has been taken as morning time. It is that portion of the day in which generally schools of Jabalpur opens, people go to their workplace or engage in their business activities. Ranital Squares has maximum value of all the basic noise parameters during morning (Chart-1). So we can say that Ranital square is the noisiest among all squares of Jabalpur during morning.

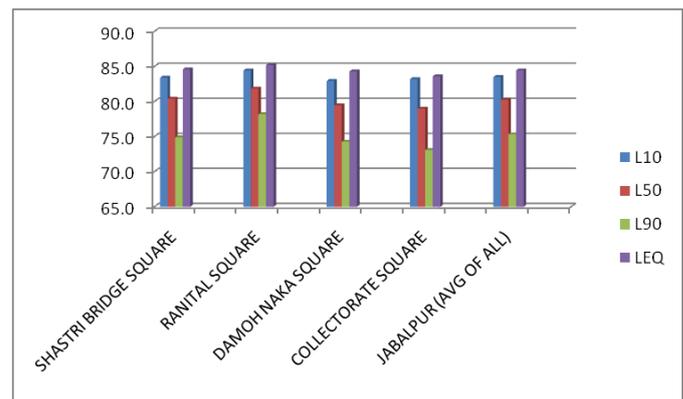


Chart -1: Variation in noise level parameters (L10, L50, L90 & LEQ) in dB(A) at different squares during morning time.

Table -1: Values of Noise level parameters in dB(A) at different squares during morning in Jabalpur city

PARAMETERS	SASTRI BRIDGE SQUARE	RANITAL SQUARE	DAMOHNAKA SQUARE	COLLECTORATE SQUARE	JABALPUR (AVG OF ALL)
L10	83.4	84.4	82.9	83.2	83.5
L50	80.4	81.9	79.5	79.0	80.2
L90	74.9	78.2	74.3	73.1	75.3
LEQ	84.6	85.2	84.3	83.6	84.4
NC	8.5	6.2	8.7	10.1	8.5
TNI	79.0	73.2	78.9	83.5	79.4
LNP	90.1	88.7	89.4	90.8	89.8

Since, TNI and LNP has maximum value (Table-1) at Collectorate Square, it is most annoyed place during morning with respect to noise pollution.

4.2 AFTERNOON

Study time between 12 am to 6 pm has been taken as afternoon time. It is that portion of the day in which generally closing of schools happens. Lunch time of offices also happens during this time. Damoh Naka Squares has maximum value of all the basic noise parameters during afternoon as shown below in (Chart-2).

Most annoyance responses due to traffic will be at Collectorate Square due to maximum value of TNI. Distraction and annoyance due to fluctuation of noise will be maximum at Damoh Naka Square due to maximum LNP (Table-2).

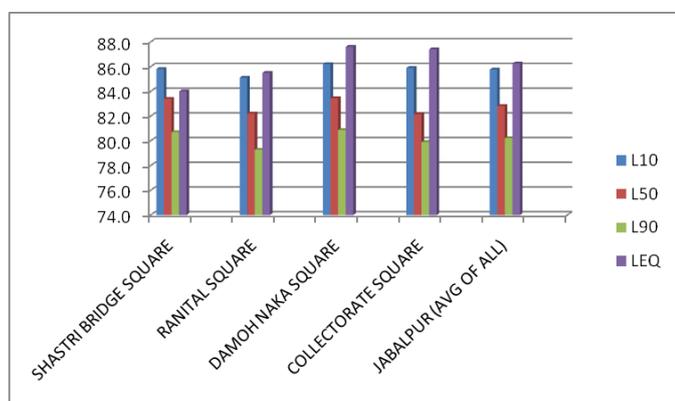


Chart -2: Variation in noise level parameters (L10, L50, L90 & LEQ) in dB(A) at different squares during afternoon time.

Table -2: Values of Noise level parameters in dB(A) at different squares during afternoon in Jabalpur city

PARAMETERS	SASTRI BRIDGE SQUARE	RANITAL SQUARE	DAMOH NAKA SQUARE	COLLECTORATE SQUARE	JABALPUR (AVG OF ALL)
L10	85.8	85.1	86.2	85.9	85.8
L50	83.4	82.2	83.5	82.2	82.8
L90	80.7	79.3	80.9	79.9	80.2
LEQ	84.0	85.5	87.6	87.4	86.2
NC	5.1	5.8	5.3	6.0	5.6
TNI	71.1	72.6	72.2	73.9	72.5
LNP	88.9	88.6	89.2	88.8	88.9

4.3 EVENING

Study time between 6 pm to 10 pm has been taken as evening time. It is that portion of the day in which generally

closing of offices happen and people return from their workplaces. It is very important duration of day as far as commercial activity in Jabalpur is considered on normal working days.

Like evening time, Damoh Naka Squares has maximum value of all basic noise parameters during evening as shown below (Chart- 3). So we can say that Damoh Naka Squares square is the noisiest among all squares of Jabalpur during evening time.

Since, TNI and LNP has maximum value (Table-3) at Damoh Naka Square, it is most annoyed place during evening with respect to noise pollution.

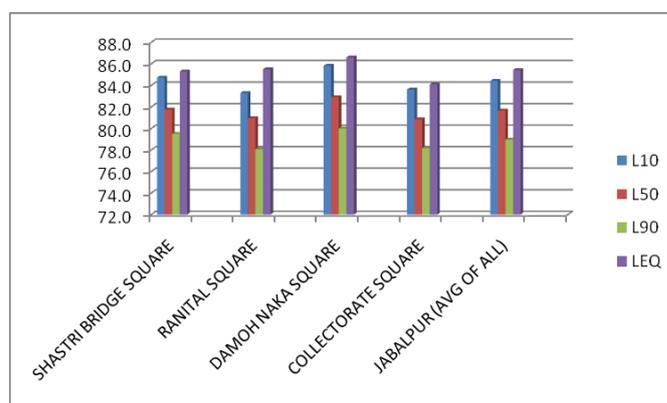


Chart -3: Variation in noise level parameters (L10, L50, L90 & LEQ) in dB(A) at different squares during evening time.

Table -3: Values of Noise level parameters in dB(A) at different squares during evening in Jabalpur city

PARAMETERS	SASTRI BRIDGE SQUARE	RANITAL SQUARE	DAMOH NAKA SQUARE	COLLECTORATE SQUARE	JABALPUR (AVG OF ALL)
L10	84.7	83.3	85.8	83.6	84.4
L50	81.8	81.0	82.9	80.9	81.7
L90	79.5	78.1	80.0	78.2	79.0
LEQ	85.3	85.5	86.6	84.1	85.4
NC	5.2	5.2	5.8	5.5	5.4
TNI	70.4	68.9	73.3	70.0	70.8
LNP	87.4	86.6	89.3	86.8	87.6

5. CONCLUSION

Traffic noise level at all the squares of Jabalpur city are well above the standard prescribed by CPCB of India. Although heavy vehicles are not permitted to enter the city in the daytime 06:00 – 22:00 o'clock but still the main fraction of transport activities are relied to personal gasoline cars and diesel buses which generate the high level of noise pollution due to poor maintenance and old technology. Traffic jams

and unregulated traffic has become an endemic feature even at major squares of Jabalpur city due to insufficient street capacity. The major parts of public buildings situated near Collectorate square are directly exposed to excessive traffic noise.

Strategic approach to noise pollution control in small urban areas like Jabalpur is crucial and should start with proper noise measurement and mapping program. If properly enforced, a series of effective and applicable control measures are available, starting from limitation of vehicles access, speed limits reduction, tires quality specification or even changes in road material. Low-noise behavior of drivers should be encouraged as well, by advocating defensive driving manners.

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