

Measurement of Noise Pollution at Different Busiest Intersections in Jabalpur City MP (India)

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Abstract— The present study was carried out to measure the noise level from vehicular traffic in Jabalpur city during different portion of day i.e. morning, afternoon and evening. Over last decades there had been rapid change population of Jabalpur city. This had significant change the traffic density at Jabalpur city. We have put an effort to assessment of noise level under traffic conditions over different slot of time .This has been determined by collecting the noise level samples from different intersection of Jabalpur city. The sampling locations are as follows 1.Shastrri Bridge intersection 2.Ranitaal intersection 3.Damoh Naka intersection 4.Collectorate intersection. 5. Ghamapur intersection. The noise level samples were assessed 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 (Leq), Traffic noise index (TNI), noise pollution level (NPL) .result higher road traffic reveals higher noise which increase dis comfort to the traffic police.

Key words: Noise level, Morning, Evening, Afternoon, intersection, Decibels

I. INTRODUCTION

Production of one or more sounds at different sound pressure levels and for different time such that it starts affecting the life of human being and biotic life in the biosphere is termed as noise pollution. According to the report given by the World Health Organization ((WHO), 2005) the third most harmful type of pollution is noise pollution. In India noise emitted from traffic contributes about 55% of total noise pollution .in survey conducted by central pollution control board it was reported that noise level in important cities are higher than permissible limit. Production of noise level number of acute and chronic effect in human being. Exposure to certain noise level can have detrimental effect on human beings and animals.

Some of the human health adverse effects related to noise pollution may be listed as –

- Noise – induced hearing loss ;
- Speech Interference communication ;
- Disturbance of rest and sleep cause insomnia
- Mental disorders – health and performance effects ;
- Effects on physiological behavior, physiological impacts and annoyance ;Interference with activities of endocrine gland, produce high blood pressure .affect heart rates and change blood components.

The study analyses the problem of noise pollution from one of the major source i.e. automobiles. An endeavor was made to measure noise levels originating from vehicles on selected tetragonsin Jabalpur city. Noise levels from vehicles through engines and horns are the main cause of

unease in cities and may possibly subsidize about 60% of whole noise pollution.

A. Factors persuading road traffic noise generation

Individual vehicle noise is a combination of noises produced by:

- the engine, horns etc.
- the horn the interaction of tires and road pavement

II. LITERATURE REVIEW

A. Introduction

A review on previous work and research has been carried out on noise level and noise parameters, its analysis and effect at different cities and occasions in India and world. A series of research papers and the result of studies carried on noise pollution and its effect were reviewed.

B. Research paper related to Noise level sampling, analysis and its effect

Amro, H.and Z. Salhab(2012) [1]evaluated vehicular noise level in Hebron city, (the largest city of about two hundred thousand population), located at the south of Palestine.The value of equivalent level noise (LAeq) was measured during three intervals ranged from 7-8 am (peak traffic hours), 14-15 pm (peak traffic hours), and 17-18 pm (non-peak traffic hours) in June 2012. Noise pollution was measured and analyzed and it was noticed that the maximum average of noise level was measured 83.05 dB(A) from 14 to 15 pm, while the minimum average was measured 74.4 dB(A) from 17 to 18 pm.

Chakraborty, D. et al. (1997) [2]reported the status of road traffic noise and community response in Calcutta metropolis in terms of seasonal basis. Based on the annoyance survey, regression association of noise parameters and percent of highly annoyed population were developed.

Ghosh, M.K., A. Lall and S. Ghosh (2016) [3] compared the level of noise pollution due to railway and vehicular traffic in various cities of our country viz. Jalandhar, Amravati and Raipur using digital sound meter along with the collection of traffic volume data. This study determined the level of noise and health impact due to rapidly growth of railway and road traffic vehicles

Ingle, S.T. et. Al(2005) [4]conducted a community survey on traffic noise among residents of Jal gaon city. The result of the audiometric study undertaken showed mild hearing impairment in both the target group (exposed and unexposed) population. Moderate hearing loss was reported in high number in subjects from the exposed group of residence

Mishra, A.K. et. Al (2016) [8] studied the noise level at two different places of Ujjain during Simhastha

Kumbh Mela-2016 Mahaparv during Shahi Snaans and other holy dip days. Due to mass gathering during kumbh mela population density and number of automobiles increased and noise level compared to normal days also increased in the city.

C. Objectives

- Improve noise management system in study area
- Assist planning for upcoming development
- Increases awareness among local people to recognize their existing noise environment
- Potential to use benchmark to for other cities reference to Indian sub continent

III. NOISE LEVEL PARAMETERS MESERING NOISE

Equivalent (A Weighted) Sound level (Leq)-This is the fixed noise which in the measurement period would carry the same energy as is prolonged by inconsistent level over the same time.

$$Leq = 10 \log \sum_{i=1}^{i=n} 10^{\frac{Li}{10}} \times ti$$

Where,

n = total number of sound samples

Li = noise level of any ith sample

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

Percentile exceeded sound Level (Lx) decibel-The noise level surpassed for x per cent of the time is denoted by Lx. The most communal noise exceeded level recycled is L₁₀ i.e. noise level beyond for 10 per cent of time. It is an recommendation of the peak level of the interfering noise, where as L₉₀ level is an pointer of the background noise level. L₅₀ is median value of dissimilar sound levels.

Traffic Noise Index (TNI)-The traffic noise index is a process used to evaluation irritation responses due to traffic noise The value of TNI over 74 dB (A) (Scholes and Sargent, 1971, Ma et al., 2006) is well-defined as the threshold of above criterion. It is calculated using the following formula (Langdon and Scholes, 1968):

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

Noise Pollution level (LNP)-It is establish that Leq on an energy basis is not enough to describe the degree of annoyance caused by changeable noise. A new constraint 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 designate public noise, which employs the equivalent continuous(A-weighted) sound level and the scale of the time variations in levels, Noise Pollution Level (LNP) is used. The measurement in considered so that it combines gradation of steadiness in time of the noise (supposing that the less steady it is, the more disrupting and annoying it becomes).

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

Noise Climate (NC)-Sound levels will be inconsistent over an interval of time. The range above which the variations occur is known as Noise Climate (NC) and is evaluated by the following formula.

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

IV. MATERIALS & METHODOLOGY

This study & sound level meter. (Envirotech SLM100, Sound Level Meter, Type 2 dBA) is used. It is used to measure the prevailing noise equivalent level (Leq) dB (A) at the various intersections (locations). The device was kept nearly to chest level (1.2m) in order to diminish errors due to reflection of sound from the body of investigator and the device was kept at 5m away from the pavement during sampling. The noise observing was done on working days e.i. 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.

A. Study Areas

Jabalpur (formerly Jubbulpore) is a tier 2 city in the state of Madhya Pradesh, India. Jabalpur word combines Arabic word Jabal (meaning- rock) and Sanskrit word-Pur(meaning- city). It is one of the most famous cities of Madhya Pradesh. According to the 2011 census, it is the third-largest urban agglomeration in Madhya Pradesh, and the country's 30th-largest urban agglomeration.

B. Economic Use

The High Court of MP is located in Jabalpur and so are many Government administrative headquarters. It is one of the major centers for the production of arms and ammunition and military base in India. The city is a major trading center and producer of forest products. Industrialization is on verge of taking off for private entrepreneurs. Nevertheless, city is experiencing fast growth in all sectors

C. Noise Pollution Standards

India, the In Noise Pollution (Regulation and Control) Rules, 2000 have been framed under the Environment (protection) act, 1986 to control community noise, Noise Pollution (Regulation and Control) Rules, 2000 notified in February 2000 and amended from time to time

Area Code	Category of Area/Zone	Leq dB (A)	
		Day time (6a.m.-10 p.m.)	Night Time (10 p.m - 6 a.m.)
(A)	Industrial area	75	70
(B)	Commercial area	65	55
(C)	Residential area	55	45
(D)	Silence Zone	50	40

V. METHODOLOGY

To study an effort is made to relate the noise level certain main areas of Jabalpur city during morning-6 to 12,afternoon-12 to 18 , evening-18 to 22. The comparison of noise data is plotted in form of chart so that it makes appropriate to differentiate the traffic noise. In each area for minute reading was taken almost 30 minutes.

The following parameters classifications are done as follows Total vehicle volume per hour

- Types of vehicle crossing the area during study
- Noise level in that areas

The different noise parameters like percentile exceeded sound level (Lx), equivalent continuous sound level (Leq), and Traffic noise index (TNI) and noise

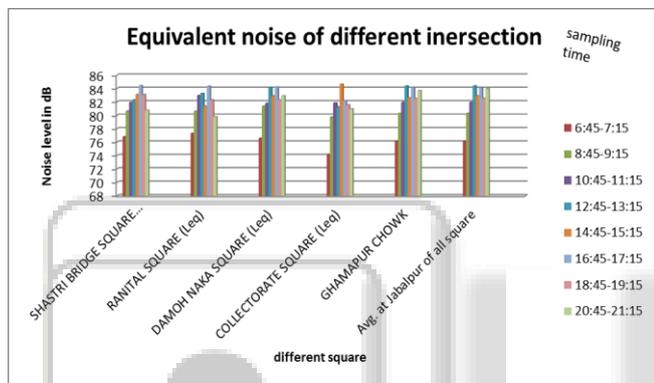
pollution level (NPL) were designed for morning, afternoon and evening time Duration to differentiate traffic noise and analyses dissimilar feature noise pollution.

VI. RESULT & DISCUSSION

Average for all the noise parameters is taken as the representation of noise level parameter of Jabalpur city as a

	SHASTRI BRIDGE SQUARE (Leq)	RANITAL SQUARE (Leq)	DAMOH NAKA SQUARE (Leq)	COLLECTORATE SQUARE (Leq)	GHAMAPUR CHOWK	Avg. at Jabalpur of all square
6:45-7:15	76.8	77.3	76.6	74.1	76.1	76.18
8:45-9:15	80.7	80.6	81.4	79.8	80.3	80.56
10:45-11:15	81.9	83.0	81.8	81.8	81.9	82.09
12:45-13:15	82.3	83.3	84.1	81.3	84.4	83.08
14:45-15:15	83.1	81.4	82.9	84.7	82.6	82.94
16:45-17:15	84.4	84.4	84.2	82.2	84.2	83.88
18:45-19:15	83.1	82.3	82.3	81.6	82.6	82.38
20:45-21:15	80.8	79.8	82.9	81.0	83.7	81.64

whole. In such analysis it is found that afternoon time has maximum value of Leq i.e. 86.2dB. Further whole analysis is done under morning, evening and afternoon time durations.



A. Morning

Analysis time between 6 am to 12 am has been observed as morning time. It is that fraction of the day in which generally schools of Jabalpur opens, people go to their workplace or employ in their business actions. Ranital Squares has maximum value of all the basic noise parameters during morning (Fig. 1). So we can say that Ranital square is the nosiest among all squares of Jabalpur during morning.

	SHASTRI BRIDGE SQUARE	RANITAL SQUARE	DAMOH NAKA SQUARE	COLLECTORATE SQUARE	GHAMAPUR SQUARE	JABALPUR (AVG OF ALL)
L10	83.4	84.43	82.94	84.6	82.3	83.5
L50	80.4	81.82	79.49	81.1	80.8	80.7
L90	74.9	78.19	74.29	74.6	75.9	75.9
LEQ	84.6	85.25	84.3	87.5	85.3	85.4

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

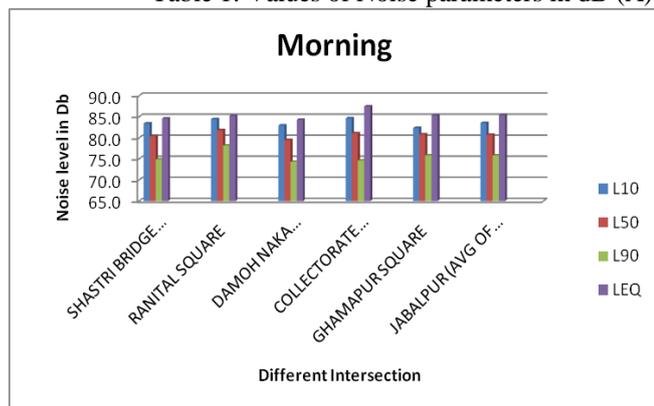


Fig. 1: Variation in noise level parameters (L10, L50, L90 & LEQ) in dB(A) at different squares during morning time

maximum value of all the basic noise parameters during afternoon as shown below in (Fig. 2).

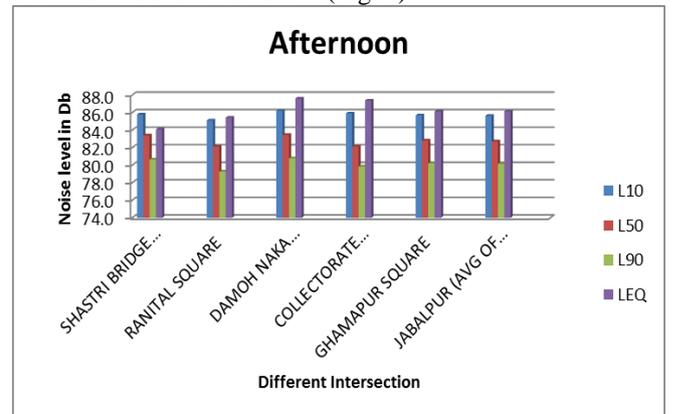


Fig. 2: Noise Variation in level parameters (L10, L50, L90 & LEQ) in dB (A) at different square during afternoon time.

B. Afternoon

Analyzed time between 12 am to 6 pm has been taken as afternoon time. It is that fraction of the day in which generally closing of schools occurs. Lunch time of offices also happens during this time. Damoh Naka Squares has

	SHASTRI BRIDGE SQUARE	RANITAL SQUARE	DAMOH NAKA SQUARE	COLLECTORATE SQUARE	GHAMAPUR SQUARE	JABALPUR (AVG OF ALL)
L10	85.8	85.1	86.2	85.9	85.7	85.6
L50	83.4	82.1	83.5	82.1	82.8	82.7
L90	80.7	79.3	80.8	79.9	80.2	80.2
LEQ	84.1	85.4	87.6	87.4	86.1	86.1

Table 2: Values of Noise parameters in dB at different squares during afternoon in Jabalpur

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.

C. Evening

Analysis time between 6 pm to 10 pm has been chosen as evening time. It is that fraction of the day in which generally closing of offices occurs and people come back from their workplaces. It is very important period of day as far as commercial activity in Jabalpur is considered on normal working days.

Like evening time, Damoh Naka intersection has maximum value of all basic noise parameters during evening as shown below in (Fig. 3). So we can say that Damoh Naka Intersection square is the nosiest among all squares of Jabalpur during evening time.

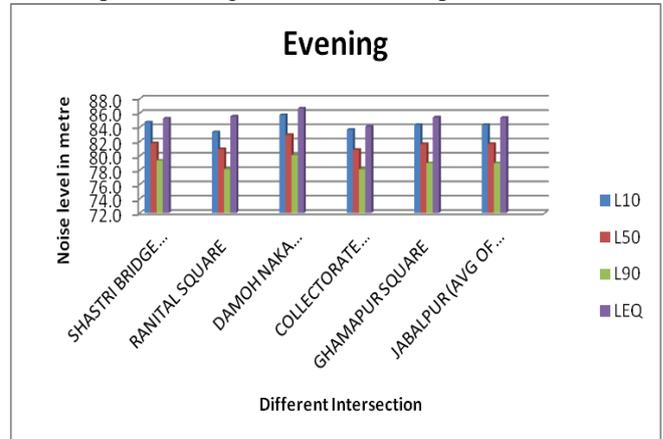


Fig. 3: Variation in noise level parameters (L10, L50, L90 & LEQ) in dB at Different squares during evening time.

	SHASTRI BRIDGE SQUARE	RANITAL SQUARE	DAMOH NAKA SQUARE	COLLECTORATE SQUARE	GHAMAPUR SQUARE	JABALPUR (AVG OF ALL)
L10	84.7	83.3	85.7	83.7	84.3	84.3
L50	81.8	81.0	82.9	80.9	81.7	81.7
L90	79.4	78.1	80.1	78.1	80.0	79.0
LEQ	85.2	85.5	86.6	84.1	85.4	85.3

Table 3: Values of Noise parameters in dB at different squares during evening in Jabalpur city

VII. CONCLUSION

Through the result obtained from study it very evident that city is suffering from severe noise pollution due to vehicular traffic .it is mainly attributed towards congested traffic zone ,unplanned road network, reduce one way traffic, construction of silence zone in main area of city .Traffic noise level at all the intersections of Jabalpur city are well over the standard prescribed by CPCB of India. Though heavy vehicles are not allowed to pass in the city in the daytime 06:00 – 22:00 o'clock but still the chief portion of transport actions are relied to individual gasoline cars and diesel buses which produce the high level of noise pollution due to poor repairs and longstanding technology. Traffic jams and tolerant traffic has become an widespread feature even at main intersections of Jabalpur city due to lacking groad capacity. The main parts of community buildings located near Collectorate intersections are directly unprotected to extreme traffic noise.

Planned method to noise pollution control in minor urban areas like Jabalpur is critical and should start with appropriate noise measurement and planning program. If correctly imposed, a series of effective and appropriate control procedures are available, starting from restriction of vehicles admittance, speed limits lessening, tires class specification or even alterations in road material. Low-noise performance of drivers should be encouraged as well, by advocating self-justifying driving behaviors.

A. Noise Pollution can be reduced as Follows

- 1) Use of noise barriers

- 2) Limitations of vehicle speed
- 3) Alteration of pavement surface texture
- 4) Limitation of heavy duty vehicles
- 5) Use of traffic control for smooth traffic flow
- 6) Innovative tires design and other methods

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