

Evaluation of present scenario of Ambient Noise Level in Residential zone and Silence zone of Jabalpur city

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Abstract - Metropolitan and big cities of the world are now facing enormous rise of noise problem due to very high population, transport congestion and associated commercial and industrial activities. Noise as pollutant produces contaminated environment that become a nuisance and affect the health of a person, his activities and mental abilities. This study investigates noise pollution in residential and silence area of Jabalpur city. Jabalpur a district headquarters and union territory of Madhya Pradesh state is one of such place where noise pollution is very frequent. Jabalpur city is selected in first round of Smart City mission under the Government of India. In order to assess noise level, noise data were collected from various location of the city by sound level meter Lutron SL-4023SD for day and night hour and the status with respect to regulatory standard given in Act " Noise pollution (Regulation and control) Rule 2000" has been evaluated. The sampling station were selected at five different location in residential area and five different location in silence area of Jabalpur city and Energy equivalent sound level for hourly observation was workout. It was found that noise level mainly influenced by vehicular traffic. It was observed that noise level of residential and silence area of city is much above the statutory limit thus it is concluded that there is need to adopt appropriate control measure for reduction of noise.

Key Words: Noise pollution, Equivalent continuous noise level, Noise Parameter, Residential Zone, Silence Zone, Jabalpur city.

1. INTRODUCTION

Sound is atmospheric or airborne vibration perceptible to ear. Noise is usually unwanted, unpleasant or disagreeable sound that causes uneasiness. Noise is a form of pollution because it can cause several physiological and psychological effects on human being. According to W.H.O (World Health Organization) noise pollution is now a day the third most hazardous environmental type of pollution preceding only by air and water pollution. Migration of people from rural to urban area, extension of urban communities, infrastructure development, population growth and urbanization are

important factors bringing about motorization and resulting increment in level of different urban contamination. In India noise pollution in urban center is gradually increases over the years. According to past survey urban centre in India have revealed that noise level are much higher than the prescribed standards. This resulted that proportion of people exposed to noise is greatly increased and has direct and indirect affect to the people that can lead to the health hazard. Some of the major health hazard causes by excessive exposure to noise are auditory damage, blood pressure, headache, migraine, increase anger, insomnia, fatigue, high blood pressure, high pulse rate, grater perspiration etc.

Noise is term used for any unwanted sound, thus it is a subjective term and varies from person to person. Particular loudness may not be liked by one person, whereas the same loudness may be quite pleasant to another person. Increasing industrialization, urbanization, and commercialization of urban area increase the noise pollution. Traffic is the dominating source of noise. The effect of noise on human health are physical effect such as hearing effect, Physiological effect such as increased blood pressure, irregularity of heart rhythms, Psychological effect such as sleeplessness, going to sleep late, Irritability annoyance and stress. The government of India has introduced the noise pollution (regulation and control) Rule 2000 for the noise producing and generating source which clearly classifies our environment in to four categories and specifies the allowable limit of noise separately for day and night time for different urban environments.

In India Noise pollution studies were carried out for various city. Vijay Sharma, Pankaj Saini, Sudhanshu kaushik and B D Joshi 2010 [13] studied noise level of different zone of Haridwar city uttarakhand state during working day and non working day noise level of selected within city is higher during working day as compared to non working day except residential zone . Chauhan et al 2010 [1] reported that industrial commercial residential and silence zones noise level in Moradabad city

was higher than prescribed limit of CPCB. Dev Pramendra and Singh Vartika 2011 [2] studied level of noise pollution in different zone in Deharadun city. The analysis has revealed that noise pollution level are rather higher than prescribed Indian standards at all examined site. During the month of September to march noise pollution of Deharadun city is higher than in compression to other month of year. Srimanta Gupta and Chitralekha Ghatak 2011 [8] the study focus on traffic noise assessment and its negative health effect on road side resident five different location were selected along a National highway of Burdwan, West Bengal having a day time Leq level 60 to 89.5 dB(A). Gayathari K , A. Amutha Jaisheeba and R. Sornaraj 2012 [3] studied noise level generated in and around Thoothukundi city of Tamilnadu. it was observed all study area sound level exceeded from normal permissible limit. Viki Das, Dr Umesh Mishra, and Sabbir kumar Jamatia 2014 [12] studied present trend of noise in Udaipur town area Tripura. Equivalent noise level (leq) is monitored in nine different stations in different part of town area at day and night time and observed that the noise level is much above the statutory limit of central pollution board CPCB. Manish Raman and R C Chhipa 2014 [5] conducted a study to determine level of environmental noise and its impact in Jaipur city. Result shows higher sound level in areas of Jaipur compared with the prescribed limit of CPCB. Swapnil R Deshmukh and Prof. D.C. Deshmukh 2015 [9] conducted study for assessment of traffic noise level at important intersection of Amravati city of Maharashtra state and its effect on surrounding environment. All noise level parameter are found to be more than prescribe limit.

2. STUDY AREA

The Jabalpur city is located between latitude 23°10'N and longitude 79°56'E in Central part of India. The city is spread over 53 sqkm area and inhabited by the population of 10.81 lakh .Jabalpur is contributing in country's defence by having gun carriage factory, ordinance factory khamariya, vehicle factory, grey iron foundary, 506 army base workshop and central ordnance depot. Jabalpur is zonal headquarter of WCR and also two national highway NH-7, NH-12 pass through Jabalpur. Jabalpur situated on bank of river Narmada. The habitation in Jabalpur is highly diversified. Beside the general requirement of calamity in some of the areas are highly noisy whereas some areas are reasonably calm. To study the intensity of noise pollution in residential and silence zone of Jabalpur city monitoring of noise level will be conducted as per guideline of the central pollution control board (CPCB) India .Total 10 location identified prior to monitoring that are listed below

Table -1: List of location which have to survey

Zone	Location Taken
Residential Zone	1.Vijay Nagar
	2.Adhartal Area
	3.Hathital Colony
	4.Wright Town
	5.Civil Line Area
Silence Zone	6.Victoria Hospital
	7.RDVV University
	8.High Court Avenue
	9.Jabalpur Engineering College
	10.Bhavartal Garden

3. METHODOLOGY

Sound level will be measured by following standard procedure prescribed by CPCB using calibrated sound level meter Lutron SL-4023SD with measuring range from 30-180 dB(A) between 9am to 11pm during working day. Standard noise level for different location during day and night time is followed according to CPCB guideline. our monitoring period comprise of 13 hr of day time (i.e.8 am to 9 am, 9 am to 10 am, 10 am to 11 am, 11 am to 12 pm, 12 pm to 1 pm, 2 pm to 3 pm, 3 pm to 4 pm, 4 pm to 5 pm, 5 pm to 6 pm, 6 pm to 7 pm, 7 pm to 8 pm, 8 pm to 9 pm) and 1 hr night time (i.e.10 pm to 11 pm). The reading will be taken at concern hours for 10 minute duration at fixed interval of 10 seconds so 60 reading are taken for each observation hours. As for as possible measurement will be taken 1.5 m above ground level and at least 3.5 m from reflecting surface. Ambient sound levels are being compared with prescribed standards of CPCB (Central Pollution Control Board) India. The national ambient air quality standard in respect of noise as specified under the noise pollution (regulation and control) rule 2000 is referred for present study. Various noise descriptors such as L_{eq} , L_{10} , L_{50} , L_{90} , L_{NP} has been evaluated to reveal the extent of noise pollution.

L_{eq} - It is an energy mean of the noise level over a specified period.

L_{10} - indicate respectively the level exceeded for 10% of time in a recorded noise level for a given interval.

L_{50} - indicate respectively the level exceeded for 50% of time in a recorded noise level for a given interval.

L_{90} - indicate respectively the level exceeded for 90% of time in a recorded noise level for a given interval.

L_{NP} - Noise pollution level $L_{NP} = L_{eq} + (L_{10} - L_{90})$

The noise levels were calculated in (L_{eq}) using the following formula.

$$L_{eq} = 10 \log_{10} \sum_{i=1}^{i=n} t_i * 10^{(L_i/10)}$$

Where, L_{eq} = Equivalent Noise Level
 n = Total number of sound samples
 L_i = The noise level of any i th sample
 t_i = Time duration of i th sample, expressed as fraction of total sample time

Table 2: The Ambient Air Quality Standards in respect of Noise given by CPCB

Area	Category of Area / Zone	Limits in dB(A) L_{eq}^*	
		Day Time	Night Time
(A)	Industrial Area	75	70
(B)	Commercial Area	65	55
(C)	Residential Area	55	45
(D)	Silence Zone	50	40

NOTE - 1. Day time shall mean from 6.00 a.m. to 10.00 p.m.
 2. Night time shall mean from 10.00 p.m. to 6.00 a.m.
 3. Silence zone is an area comprising not less than 100 meters around hospitals, educational institutions, courts, religious places or any other area which is declared as such by the competent authority.
 4. Mixed categories of areas may be declared as one of the four above mentioned categories by the competent authority.

* dB(A) L_{eq} denotes the time weighted average of the level of sound in decibels on scale A which is relatable to human hearing.

"A", in dB(A) L_{eq} , denotes the frequency weighting in the measurement of noise and corresponds to frequency response characteristics of the human ear.

4. OBSERVATIONS AND DISCUSSION

The study is conducted over 10 important station which are located in different parts of Jabalpur city. Table: 3 and Table: 4 show different noise parameter in day and night time of all Residential and silence area respectively. Residential area includes Vijay Nagar, Adhartal Area, Hathital Colony, Wright Town, Civil Line Area and Silence Area included Victoria Hospital, RDVV Campus, Highcourt Avenue, Jabalpur Engineering College Campus, Bhavartal Garden.

The equivalent noise levels (L_{eq}) in different residential area of Jabalpur city have been shown in table-3 and Fig 1-5. Minimum and Maximum Equivalent sound pressure level ranges between 53.0 dB(A) to 72.6 dB(A). Equivalent Noise level in all the residential area exceeded the standard value of 55 dB(A) during daytime and 45 dB(A) during night time. Wright town area is found to have the maximum Equivalent Noise level 72.6 dB(A) during day time (5-6 pm). Maximum equivalent noise level observed in day time at Vijay Nagar, Adhartal Area, Hathital Colony, Wright Town and Civil Line are 70.3 dB(A), 63.0 dB(A) 71.1 dB(A), 72.6 dB(A) and 70.8 dB(A) respectively. Maximum equivalent noise level observed in night time at Vijay Nagar, Adhartal Area, Hathital Colony, Wright Town and Civil Line are 61.1 dB(A), 53.0 dB(A) 53.8 dB(A), 55.5 dB(A) and 59.1 dB(A) respectively. The main reasons of noise in residential area are traffic movement and vehicular horn, household equipment and appliances and construction work.

In silence area as shown in table-4 and Fig 6-10 Minimum and Maximum Equivalent sound pressure level ranges between 48.2 dB(A) to 76.5 dB(A). Equivalent Noise level in all the silence area much above the standard value of 50 dB (A) during day time and 40 dB(A) during night time. Maximum equivalent noise level observed in day time at Victoria Hospital, RDVV Campus, High court Avenue, Jabalpur Engineering College Campus, Bhavartal Garden are 64.5 dB(A), 59.8 dB(A) 76.5 dB(A), 65.3 dB(A) and 65.4 dB(A) respectively. Maximum equivalent noise level observed in night time at Victoria Hospital, RDVV Campus, High court Avenue, Jabalpur Engineering College Campus, Bhavartal Garden are 52.4 dB(A), 48.2 dB(A) 70.9 dB(A), 55.6 dB(A) and 54.8 dB(A) respectively. Thus it is seen noise pollution is exceeded permissible limit at each location during day and night time. The high court avenue found to be highly noise polluted

Table3: Noise parameters (Leq, L10, L50, L90, and LNP) at different monitored location of Residential Zone at different time interval.

Date	Site	Time	Leq	L10	L50	L90	LNP
18/5/2016	VIJAY NAGAR	8 AM -9 AM	62.1	64.0	61.5	56.9	69.2
		9 AM-10 AM	69.2	71.7	65.7	61.9	79.0
		10 AM-11 AM	67.4	70.9	65.4	62.4	75.9
		11 AM-12 PM	65.9	68.8	63.5	61.6	73.0
		12 PM-01 PM	67.1	69.7	64.5	60.5	76.3
		02 PM-03 PM	63.2	64.5	62.4	58.8	68.9
		03 PM-04 PM	63.4	66.1	61.5	57.8	71.6
		04 PM-05 PM	64.5	65.1	61.5	59.1	70.6
		05 PM-06 PM	65.5	67.4	63.8	61.4	71.5
		06 PM-07 PM	70.3	75.3	63.0	60.1	85.6
20/5/2016	ADHARTAL	8 AM -9 AM	58.9	60.5	58.4	55.4	64.0
		9 AM-10 AM	60.2	61.5	58.9	55.6	66.2
		10 AM-11 AM	56.4	57.7	55.5	54.8	59.3
		11 AM-12 PM	59.2	61.0	58.8	55.3	64.9
		12 PM-01 PM	60.0	62.3	57.6	55.8	66.5
		02 PM-03 PM	59.5	60.3	57.6	56.1	63.7
		03 PM-04 PM	59.1	59.8	57.9	53.9	64.9
		04 PM-05 PM	59.9	60.7	58.7	57.1	63.5
		05 PM-06 PM	59.1	60.4	58.6	54.4	65.1
		06 PM-07 PM	60.0	61.4	59.2	55.4	66.0
23/5/2016	HATHITAL COLONY	8 AM -9 AM	65.4	65.0	61.8	53.6	76.7
		9 AM-10 AM	68.4	72.3	64.7	59.1	81.7
		10 AM-11 AM	71.1	71.4	68.2	65.6	76.9
		11 AM-12 PM	69.6	72.2	67.7	64.8	77.0
		12 PM-01 PM	70.6	71.0	66.9	61.7	79.9
		02 PM-03 PM	60.2	63.9	56.8	50.6	73.6
		03 PM-04 PM	61.7	64.4	60.7	55.4	70.7
		04 PM-05 PM	61.6	65.0	59.8	56.1	70.5
		05 PM-06 PM	65.0	66.2	63.6	57.7	73.5
		06 PM-07 PM	69.1	72.7	65.3	62.6	79.2
26/5/2016	WRIGHT TOWN	8 AM -9 AM	59.9	62.2	58.0	54.6	67.5
		9 AM-10 AM	66.4	67.9	64.4	60.9	73.4
		10 AM-11 AM	72.2	76.8	66.6	61.4	87.6
		11 AM-12 PM	66.4	69.7	62.9	60.0	76.0
		12 PM-01 PM	67.7	70.2	64.9	61.3	76.5
		02 PM-03 PM	63.4	61.4	59.9	58.1	66.7
		03 PM-04 PM	64.4	65.8	62.0	59.2	71.0
		04 PM-05 PM	66.3	66.7	64.7	64.0	69.0
		05 PM-06 PM	72.6	68.9	64.7	62.0	79.5
		06 PM-07 PM	68.5	70.6	67.1	62.5	76.6
30/5/2016	CIVIL LINE AREA	8 AM -9 AM	60.6	63.1	59.5	56.8	67.0
		9 AM-10 AM	63.8	65.2	64.6	58.4	70.7
		10 AM-11 AM	65.1	68.0	64.5	61.2	71.9
		11 AM-12 PM	70.6	70.6	63.7	60.8	80.4
		12 PM-01 PM	70.8	69.5	64.8	60.0	80.4
		02 PM-03 PM	64.5	62.6	61.6	53.8	73.3
		03 PM-04 PM	65.4	67.7	62.5	59.3	73.8
		04 PM-05 PM	65.9	67.6	65.6	58.8	74.7
		05 PM-06 PM	69.4	73.0	66.7	61.3	81.1
		06 PM-07 PM	68.5	69.7	66.6	64.6	73.6

Table 4: Noise parameters (Leq, L10, L50, L90, and LNP) at different monitored location of Silence Zone at different time interval.

Date	Site	Time	Leq	L10	L50	L90	LNP
31/5/2016	VICTORIA HOSPITAL	8 AM -9 AM	57.0	56.8	55.9	58.9	54.9
		9 AM-10 AM	59.0	60.7	57.3	55.5	64.2
		10 AM-11 AM	63.3	65.1	61.2	58.7	69.7
		11 AM-12 PM	64.1	66.5	63.0	58.3	72.2
		12 PM-01 PM	61.9	65.0	58.8	57.0	69.9
		02 PM-03 PM	62.1	64.9	60.4	57.1	69.9
		03 PM-04 PM	54.2	57.4	53.1	50.0	61.6
		04 PM-05 PM	62.3	62.9	58.1	53.2	72.0
		05 PM-06 PM	64.5	64.8	64.4	64.2	65.1
		06 PM-07 PM	60.4	60.7	60.2	59.9	61.2
1/6/2016	RDVV CAMPUS	8 AM -9 AM	48.9	48.7	47.5	44.5	53.1
		9 AM-10 AM	55.7	59.2	53.9	48.2	66.7
		10 AM-11 AM	59.8	62.9	56.9	55.4	67.3
		11 AM-12 PM	58.1	60.7	57.0	52.2	66.6
		12 PM-01 PM	57.3	60.9	54.3	52.1	66.1
		02 PM-03 PM	58.8	59.4	56.9	53.7	64.5
		03 PM-04 PM	48.4	50.0	47.1	46.0	52.4
		04 PM-05 PM	49.8	52.1	48.3	46.5	55.4
		05 PM-06 PM	50.6	53.3	48.5	45.9	58.0
		06 PM-07 PM	48.1	51.1	47.0	44.0	55.2
2/6/2016	HIGH COURT AVENUE	8 AM -9 AM	68.6	70.6	67.4	62.9	76.3
		9 AM-10 AM	73.9	76.7	73.1	70.3	80.3
		10 AM-11 AM	76.0	78.9	72.1	67.9	86.9
		11 AM-12 PM	75.8	78.4	74.7	72.2	82.0
		12 PM-01 PM	76.5	78.5	75.1	72.4	82.6
		02 PM-03 PM	73.2	74.5	71.9	69.8	77.9
		03 PM-04 PM	76.1	78.0	75.6	71.4	82.7
		04 PM-05 PM	75.2	77.2	74.4	69.8	82.6
		05 PM-06 PM	74.3	75.7	73.3	71.8	78.2
		06 PM-07 PM	74.7	75.6	74.3	73.3	76.9
3/6/2016	JABALPUR ENGINEERING COLLEGE CAMPUS	8 AM -9 AM	58.8	60.6	57.5	55.8	63.5
		9 AM-10 AM	65.3	62.4	61.1	57.1	70.5
		10 AM-11 AM	59.5	61.0	58.8	56.6	64.0
		11 AM-12 PM	59.5	60.6	59.6	56.9	63.2
		12 PM-01 PM	58.6	60.4	58.1	56.8	62.2
		02 PM-03 PM	60.5	61.7	58.8	56.6	65.5
		03 PM-04 PM	60.2	62.0	58.4	55.2	67.0
		04 PM-05 PM	60.4	60.1	56.9	55.2	65.2
		05 PM-06 PM	57.8	59.8	57.7	55.5	62.1
		06 PM-07 PM	58.5	60.8	56.6	55.7	63.7
4/6/2016	BHAVARTAL GARDEN	8 AM -9 AM	60.6	62.1	59.8	58.4	64.3
		9 AM-10 AM	62.1	63.9	62.3	56.4	69.6
		10 AM-11 AM	64.3	65.5	64.1	60.9	68.9
		11 AM-12 PM	63.7	64.9	63.8	61.4	67.2
		12 PM-01 PM	65.4	66.2	65.3	62.0	69.6
		02 PM-03 PM	63.4	64.2	63.2	60.5	67.0
		03 PM-04 PM	64.5	66.6	63.8	59.9	71.2
		04 PM-05 PM	61.0	62.6	59.5	58.8	64.8
		05 PM-06 PM	61.6	64.0	59.3	58.1	67.6
		06 PM-07 PM	60.9	61.9	60.0	59.2	63.6

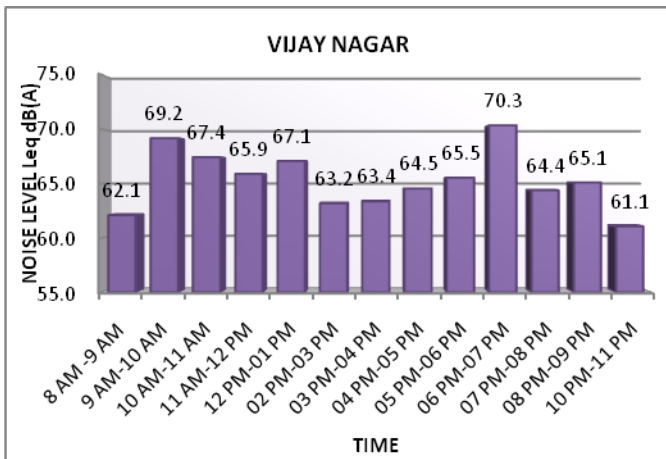


Fig 1: Temporal distribution of equivalent noise level Leq dB(A) near Vijay Nagar

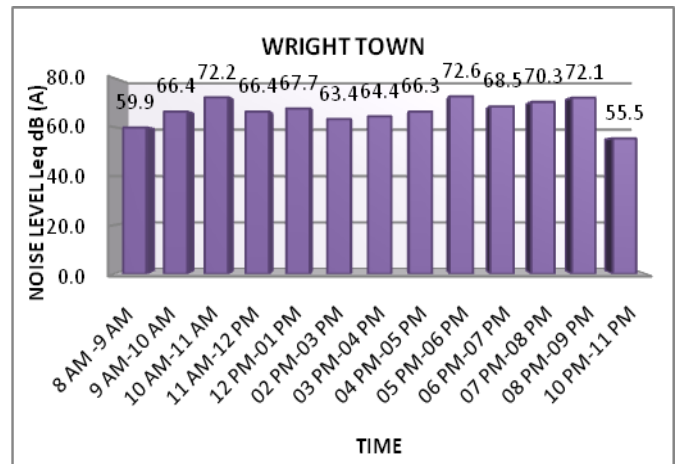


Fig 4: Temporal distribution of equivalent noise level Leq dB(A) near Wright town

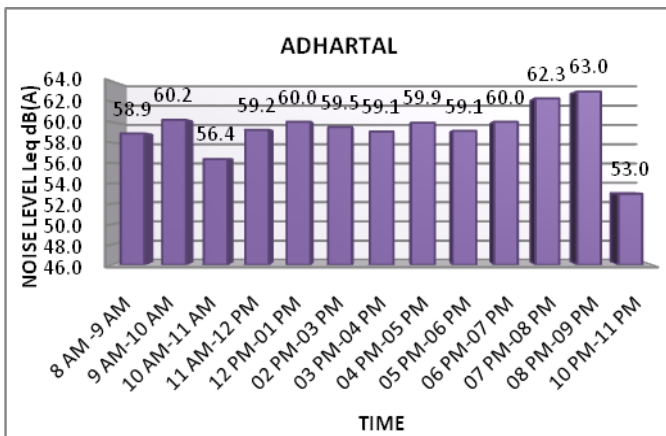


Fig 2: Temporal distribution of equivalent noise level Leq dB(A) near Adhartal Area

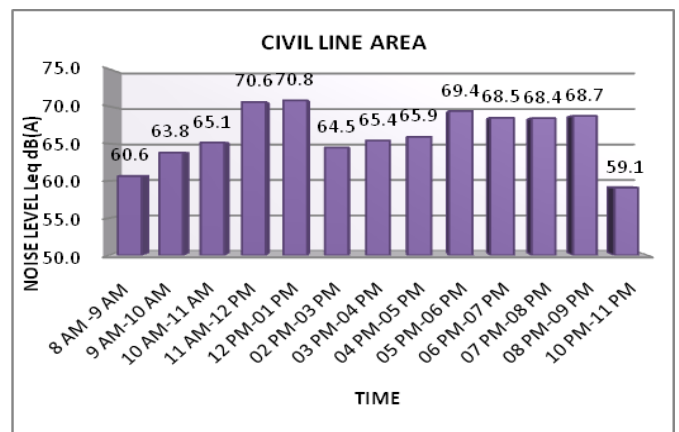


Fig 5: Temporal distribution of equivalent noise level Leq dB(A) near Civil Line Area

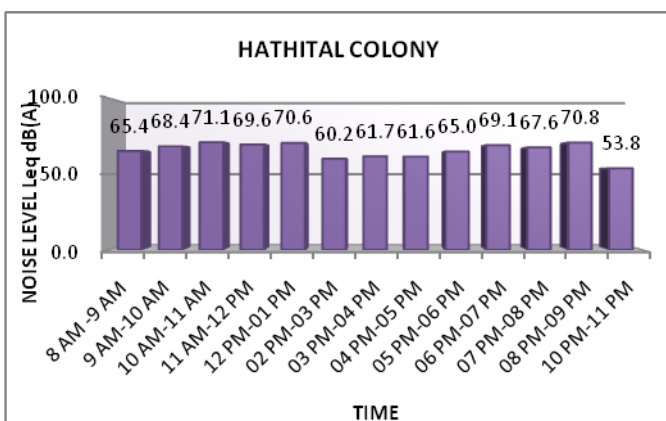


Fig 3: Temporal distribution of equivalent noise level Leq dB(A) near Hathital Colony

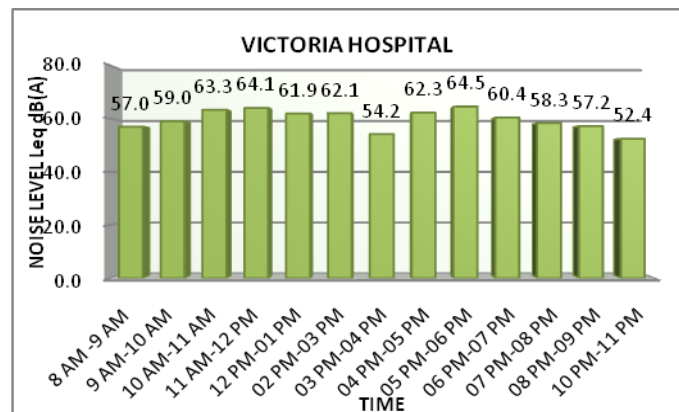


Fig 6: Temporal distribution of equivalent noise level Leq dB(A) near Victoria Hospital

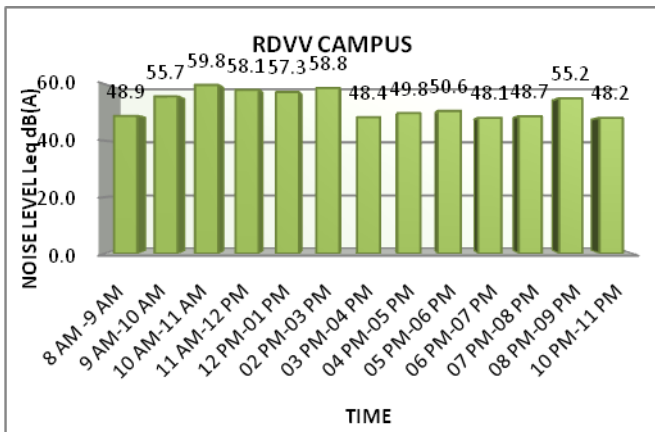


Fig 7: Temporal distribution of equivalent noise level Leq dB(A) near RDVV Campus

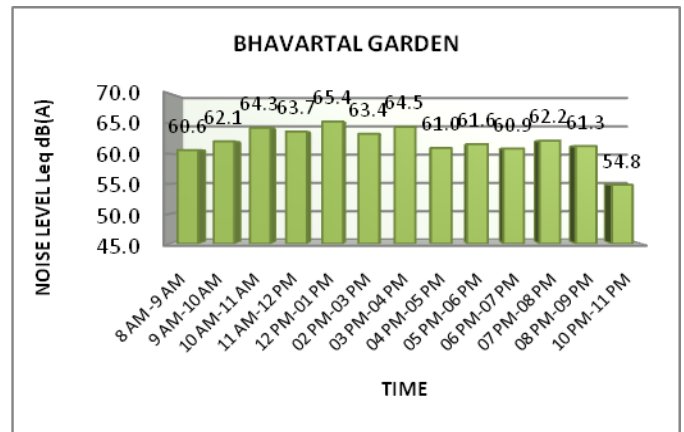


Fig 10: Temporal distribution of equivalent noise level Leq dB(A) near Bhavartal Garden

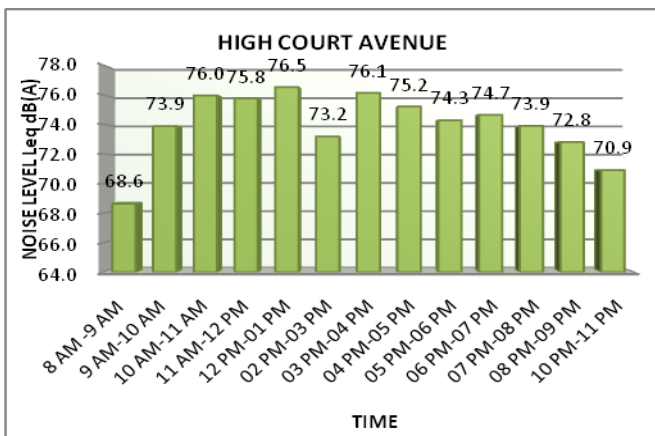


Fig 8: Temporal distribution of equivalent noise level Leq dB(A) near Highcourt Avenue

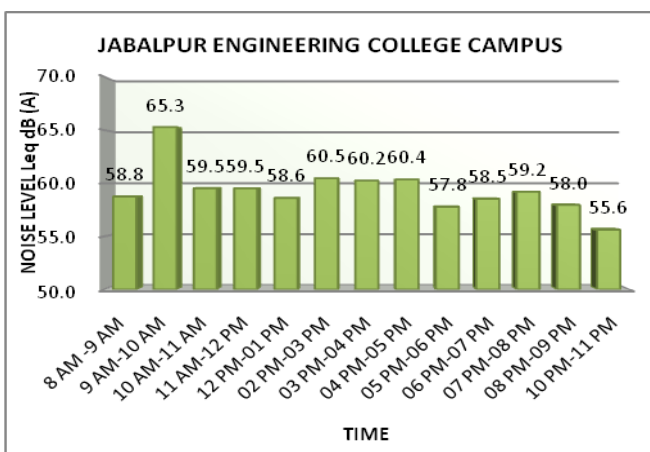


Fig 9: Temporal distribution of equivalent noise level Leq dB(A) near JEC Campus

5. CONCLUSIONS

The investigation reveals that the Residential Zone and Silence Zones of Jabalpur City are highly exposed to noise pollution. Spontaneous urbanization, heavy traffic flow and vehicle horn are the main reason that cause noise pollution in the city. Subsequently appropriate planning of city, sufficient road facilities for easy movement of traffic, reduce vehicular movement, proper maintenance of road and vehicle, street side noise barriers and plantation will be solution of such type noise pollution. Individual participation and awareness in the matter of environment and application of already existing laws effectively may assume imperative part in prevention and control of noise.

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