
STUDY OF NOISE LEVEL IN COMMERCIAL ZONE AND RESIDENTIAL ZONE OF INDORE CITY

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Abstract - Noise pollution is recognized as a major problem for the quality of life in urban area all over the world. Increasing industrialization, urbanization, and commercialization of urban area increase the noise pollution. Traffic is the main source of noise. Noise pollution is considered as environmental stressor which now becomes a problem of all over the world especially in developing countries like India. Noise as pollutant produce contaminated environment that become a nuisance and affect the health of a person, his activities and mental abilities. Today one of the major environmental pollution due to anthropogenic activities is noise pollution.

Indore city is the most populous and the largest city in the India state of Madhya Pradesh. it is also considered as an education hub of the state and has campuses of both the Indian institute of technology and the Indian institutes of management. Located on the southern edge of malwa plateau, at the average altitude of 553 meters (1814 ft) above sea level. it has highest elevation among major cities of central India. The city is 190km west of the state capital of Bhopal. Indore 2023 population is now estimated at 3113445 and selected in first round of smart city mission under the government of India. The rapid growth and development of city in terms of industrialization, Increase of traffic and urbanization causing increasing trends of noise level. The present study is concerned with assessment of ambient noise level in different zone of Indore city in August 2023.Noise level study was conducted at 10 different locations in two different zones (residential zone, commercial zone) of Indore and recorded noise data are interpreted in form of parameter Leq, L10, L50, L90, LNP.

The Leq Value in different hours of different location compared whit prescribed standard of central pollution Control Board (CPCB) and it was observed that in all the study area sound level is much above the maximum permissible limit in peat hour. This study reveals different area of Indore city is highly exposed to noise pollution and there is a need to adopt suitable control measure for reduction of noise.

Keywords: Noise Pollution, Sound Level Meter, Noise Parameter, Commercial Zone, Industrial Zone, Indore 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 centre 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 cities. 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.

2. STUDY AREA

The Indore city is located in the western region of Madhya Pradesh (approx 76° E, 23°N), on the southern edge of the Malwa plateau, on the saraswati and khan river, which are tributaries of the Shipra River. Indore has an average elevation of 553 meter above mean sea level. Indore estimated population of 3113445. Indore is served by Devi Ahilyabai Holkar international Airport, about 8km from the city. Indore is also three national highway NH-52, NH-47, NH59 pass through indore. To study the intensity of noise pollution in commercial, and residential zone of Indore city monitoring of noise level will be conducted as per guideline of the central pollution control board (CPCB) India Total 6 location identified prior to monitoring that are listed below.

Table -1: List of location which have to survey

Zone	Location Taken
Commercial Zone	1. Vijay Nagar
	2. Bhawarkua
	3. Rajwada
	4. Patnipura
	5. Janjeerwala Chowk
Residential zone	1. Palasia
	2. Scheme 78
	3. Scheme 54

3. METHODOLOGY

Sound level will be measured by following standard procedure prescribed by CPCB using calibrated sound level meter Lurton SL-4023SD with measuring range from 30-180 dB(A) between 8am to 9pm 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. 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. 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 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 using the following formula.

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

Area	Category of Area / Zone	Limits in dB(A) *	
		Day Time	Night Time
(A)	Residential Area	55	45
(B)	commercial zone	65	55

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) Leq 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) Leq, denotes the frequency weighting in the measurement of noise and corresponds to frequency response characteristics of the human ear.

Observation and Calculation Commercial Area

Table 3: Noise parameters (Leq, L10, L50, L90, and LNP) at different monitored location of Commercial zone at different time interval.

ZONE	DATE	LOCATION	TIME	Leq	L10	L50	L90	LNP
Commercial Area	05/9/2023	VIJAY NAGAR	8AM-9AM	62.0	63.7	62.0	59.4	66.3
			9AM-10AM	68.0	69.5	67.9	65.8	71.7
			10AM-11AM	66.5	69.8	65.8	63.0	73.3
			11AM-12PM	64.7	67.0	63.9	62.4	69.3
			12PM-01PM	65.3	67.4	65.3	62.8	69.9
			02PM-03PM	61.7	63.7	61.3	59.1	66.3
			03PM-04PM	61.4	63.0	61.3	59.3	65.1
			04PM-05PM	63.1	65.4	63.0	60.4	68.1
			05PM-06PM	65.1	67.0	64.4	63.0	69.1
			06PM-07PM	66.6	68.3	66.8	63.8	71.1
	07PM-08PM	61.2	62.4	61.3	58.8	64.8		
	08PM-09PM	63.2	64.9	62.1	60.2	67.9		
	07/9/2023	Bhawarhwa	8AM-9AM	60.2	64.4	60.2	57.0	67.6
			9AM-10AM	64.3	66.0	65.8	59.2	71.1
			10AM-11AM	66.4	69.2	65.8	62.8	72.8
			11AM-12PM	71.2	71.5	64.8	62.0	80.7
			12PM-01PM	71.2	70.4	65.9	61.8	79.8
			02PM-03PM	65.8	63.4	62.8	54.9	74.3
			03PM-04PM	66.8	68.4	63.5	60.7	74.5
			04PM-05PM	66.9	68.7	68.7	59.2	76.4
			05PM-06PM	70.2	74.5	67.9	62.8	81.9
			06PM-07PM	69.8	70.2	68.7	65.2	74.8
	07PM-08PM	69.3	72.8	68.1	58.4	83.7		
	08PM-09PM	69.0	72.1	68.3	65.8	75.3		
	8/9/2023	Rajwada	8AM-9AM	66.3	65.9	62.3	56.2	76.0
			9AM-10AM	69.5	72.3	65.4	60.7	81.1
			10AM-11AM	72.3	71.8	69.3	66.5	77.6
			11AM-12PM	70.2	72.6	68.1	64.9	77.9
			12PM-01PM	71.3	72.6	67.5	62.4	81.5
			02PM-03PM	61.3	63.5	57.4	52.3	72.5
			03PM-04PM	62.3	65.4	61.9	56.8	70.9
			04PM-05PM	66.5	67.8	64.2	58.4	75.9
			05PM-06PM	67.4	67.4	64.2	58.9	76.0
			06PM-07PM	70.2	71.6	66.5	63.8	78.0
	07PM-08PM	68.2	70.6	66.9	64.8	74.0		
	08PM-09PM	70.8	72.1	65.7	58.5	84.4		
		Patnipura	8AM-9AM	60.5	63.5	59.8	56.2	67.8
			9AM-10AM	67.8	68.9	64.5	62.8	73.9
			10AM-11AM	73.5	77.8	67.1	62.9	88.4
			11AM-12PM	67.8	70.2	64.2	61.9	76.1
			12PM-01PM	68.9	71.5	65.8	62.7	77.6

	09/2/2023		02PM-03PM	64.8	62.8	60.3	59.4	68.2
			03PM-04PM	67.5	67.9	65.2	60.8	74.8
			04PM-05PM	67.2	68.2	65.4	65.9	69.5
			05PM-06PM	73.5	69.4	65.2	63.0	79.9
			06PM-07PM	69.2	71.5	68.9	63.7	77.0
			07PM-08PM	71.3	74.5	69.5	63.4	82.4
			08PM-09PM	72.1	70.4	67.8	63.5	79.0
	12/9/2023	Janjeerwal a chowk	8AM-9AM	59.6	62.5	56.6	55.8	66.3
			9AM-10AM	61.3	62.4	59.1	56.6	67.1
			10AM-11AM	57.6	58.2	56.3	55.9	59.9
			11AM-12PM	60.2	62.3	59.2	56.4	66.1
			12PM-01PM	65.5	68.4	63.2	61.6	73.3
			02PM-03PM	60.8	61.3	58.9	57.5	64.6
			03PM-04PM	60.5	60.9	58.2	56.2	65.2
04PM-05PM			61.2	61.9	59.2	58.7	64.4	
05PM-06PM			60.5	61.5	59.8	56.3	65.7	
06PM-07PM			61.1	62.8	60.3	56.7	68.0	
		07PM-08PM	63.5	66.5	62.3	58.2	71.8	
		08PM-09PM	64.3	66.4	62.5	59.6	71.1	

VIJAY NAGAR

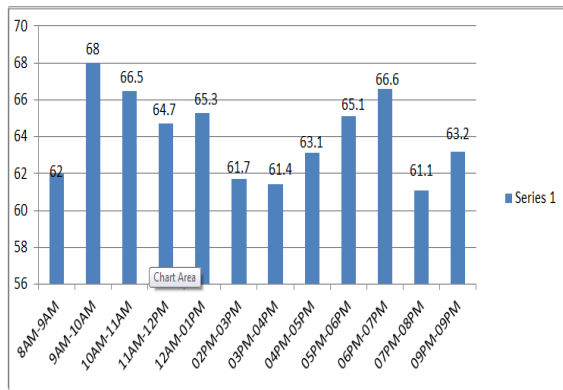


Fig 1: Temporal distribution of equivalent noise level Leq dB near vijay Nagar

RAJWADA

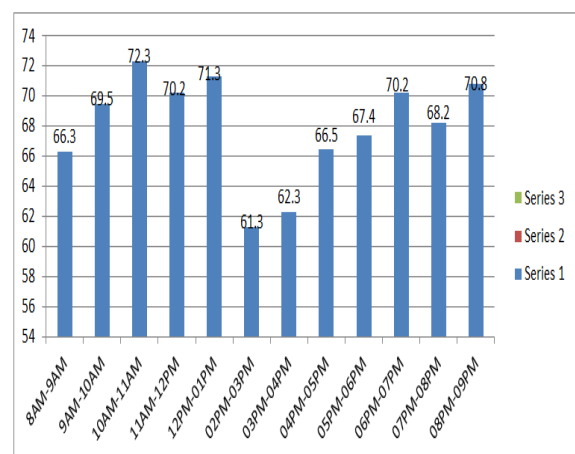


Fig 3: Temporal distribution of equivalent noise level Leq dB near rajwada

BHAWARKUA

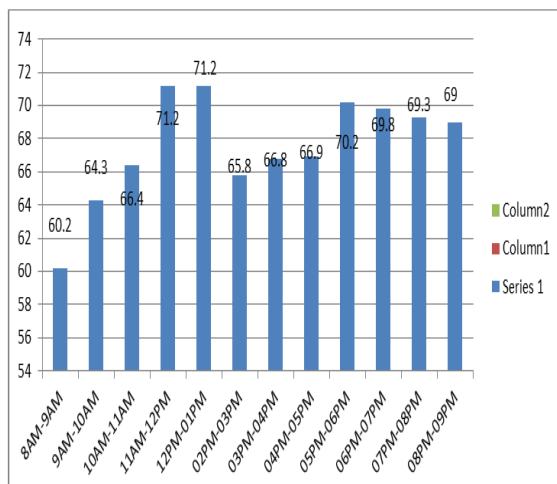


Fig 2: Temporal distribution of equivalent noise level Leq dB near bhawarkua

PATNIPURA

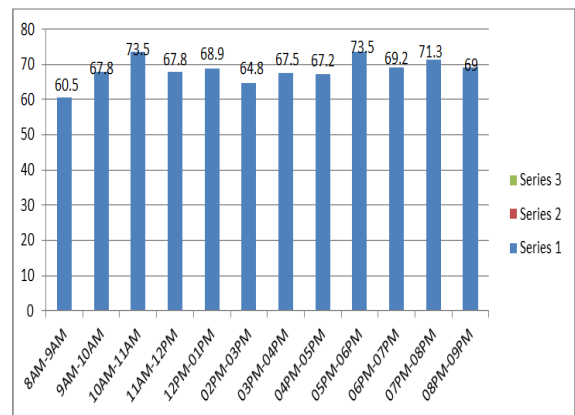


Fig 4: Temporal distribution of equivalent noise level Leq dB near patnipura

JANJEERWALA CHOWK

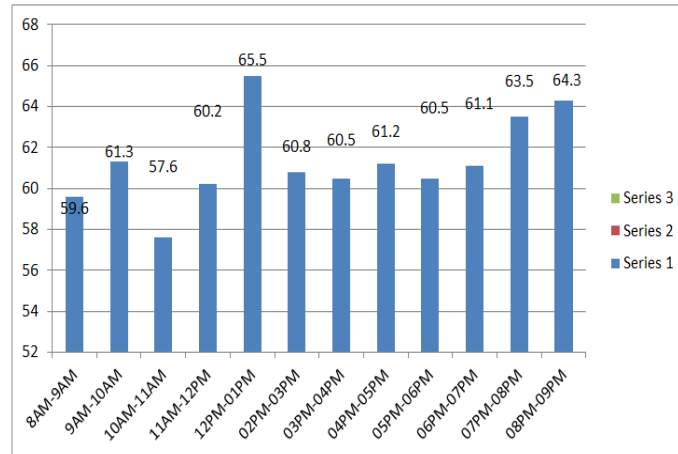


Fig 5: Temporal distribution of equivalent noise level Leq dB near Janjeerwala Chowk

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

ZONE	DATE	LOCATION	TIME	Leq	L10	L50	L90	LNP
Residential zone	14/9/2023	Palasia	8AM-9AM	58.5	57.6	56.2	59.8	56.3
			9AM-10AM	60.2	61.1	58.6	56.9	64.4
			10AM-11AM	64.2	66.5	62.5	59.0	71.7
			11AM-12PM	65.2	66.9	64.2	59.0	73.1
			12PM-01PM	62.5	66.3	58.2	58.1	70.7
			02PM-03PM	63.1	65.2	61.8	58.7	69.6
			03PM-04PM	55.3	58.4	56.1	52.9	60.8
			04PM-05PM	63.2	63.5	59.1	56.8	69.9
			05PM-06PM	65.1	65.9	65.8	64.8	66.2
			06PM-07PM	61.7	62.8	63.7	60.4	64.1
	07PM-08PM	59.3	62.5	56.8	48.6	73.2		
	08PM-09PM	58.6	60.4	56.8	48.2	70.8		
	15/9/2023	Scheme 78	8AM-9AM	49.7	47.9	46.3	45.8	51.8
			9AM-10AM	56.2	60.0	64.1	49.1	67.1
			10AM-11AM	60.2	62.4	56.9	56.1	66.2
			11AM-12PM	59.7	61.8	57.1	53.8	67.9
			12PM-01PM	58.1	61.2	55.3	53.7	65.6
			02PM-03PM	59.4	60.2	58.1	54.1	65.5
			03PM-04PM	49.1	51.3	48.1	47.4	53.0
			04PM-05PM	50.1	53.0	49.7	47.1	56.0
			05PM-06PM	51.6	53.4	49.6	46.1	63.9
			06PM-07PM	49.1	50.1	49.7	45.3	53.9
	07PM-08PM	49.9	50.6	47.1	45.8	54.7		
	08PM-09PM	56.1	60.2	52.8	50.7	65.6		
	18/9/2023	Scheme 54	8AM-9AM	59.8	61.5	58.3	56.7	64.6
			9AM-10AM	66.1	63.8	62.4	58.1	71.9
			10AM-11AM	60.2	61.5	58.7	56.7	65.0
			11AM-12PM	60.2	61.8	61.7	58.1	63.9
			12PM-01PM	59.3	61.0	59.1	67.8	52.5
			02PM-03PM	61.7	62.3	59.1	67.5	56.5
03PM-04PM			61.0	62.3	65.0	56.3	65.9	
04PM-05PM			60.4	60.1	56.9	55.2	65.3	
05PM-06PM			58.3	60.1	58.3	56.4	62.0	
06PM-07PM			59.1	61.7	57.9	56.9	63.9	
07PM-08PM	60.7	61.2	58.9	57.1	64.8			
08PM-09PM	59.8	61.5	58.3	56.7	64.6			

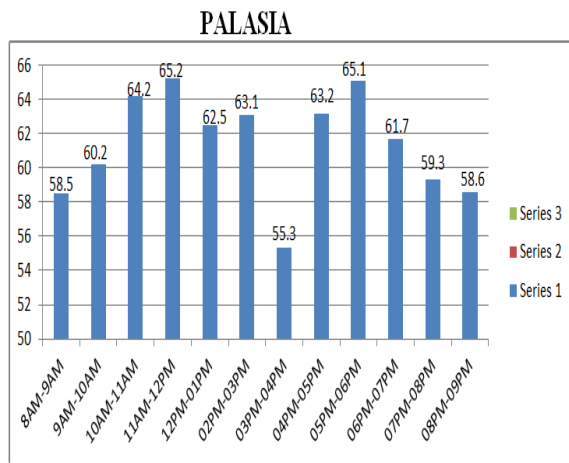


Fig 6 Temporal distribution of equivalent noise level Leq dB palasia

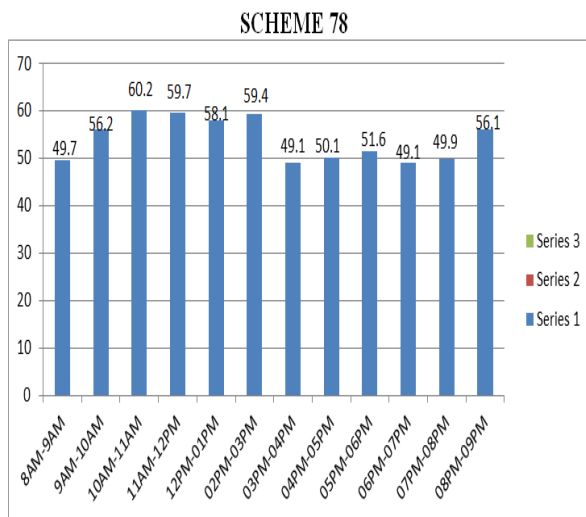


Fig 7: Temporal distribution of equivalent noise level Leq dB scheme 78

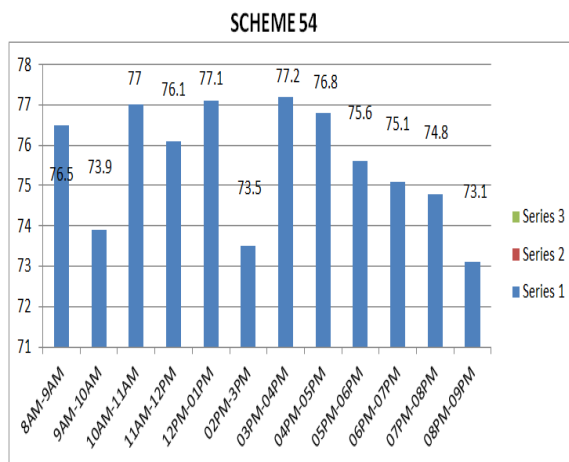


Fig 8: Temporal distribution of equivalent noise level Leq dB scheme 54

5 RESULT DISCUSSION

Commercial area

In Commercial area shown in table-5.1 and Fig 5.1-5.5 and 5.11 Minimum and Maximum Equivalent sound pressure level between 64.3 dB to 73.5 dB Equivalent Noise level in all the Commercial area exceeded the standard value of 65 dB during daytime and 55 dB during night time.

Patnipura area is found to have the maximum Equivalent Noise level 73.5 dB during day time (10am-11ampm). Maximum equivalent Noise level observed in day time at Vijay nagar, Bhawarkua, Rajwada, Patnipura and Janjeerwala Chowk are 68.0 dB, 65.5 dB, 72.3 dB, 73.5 dB and 71.5 dB respectively. Maximum equivalent noise level observed in night time at Vijay nagar, Bhawarkua, Rajwada, Patnipura and Janjeerwala Chowk are 66.6 dB, 64.3 dB, 70.8 dB, 72.1 dB and 79.8 dB respectively. The main reasons of noise in Commercial area traffic movement at vehicles horn.

Residential area

In residential area as shown in table 5.2 and Fig 6-10 and 5.12 Minimum and Maximum Equivalent sound pressure level ranges between 56.1 dB to 66.1 dB. Equivalent Noise level in all the residential area much have above the standard value of 55 dB, during day time and 45 dB during night time. maximum equivalent noise level observed in day time at palasia, scheme78, and scheme54 are 65.2 dB, 60.2 dB, and 66.1 dB. respectively. Maximum equivalent noise level observed in night time at palasia, scheme78, and scheme54 are 61.7 dB, 56.1 dB, and 60.7 dB respectively. Thus it is seen noise pollution is exceeded permissible limit at each location during day and night time. The palasia, scheme78, and scheme54 found to be highly noise polluted area in residential zone. The main reasons of noise in residential zone traffic movement at vehicles horn, household equipment and construction work.

6 CONCLUSION

The investigations reveal that the Indore cities are highly exposed to noise pollution. Rapid urbanization and heavy traffic flow and vehicle horn are the main

reason that poses noise pollution in the town. Hence to keep the noise level within the acceptable limit the following noise control measure should be followed.

1. Movement of vehicles on the inner arterial roads should be restricted.
2. The vehicles should not generate noise more than that limit prescribed by the Regulatory Authorities.
3. Heavy vehicles movement near residential and silence area should be restricted.
4. The noisiest three wheeler tempo should be banned.
5. There should be restriction on the use of horn by vehicles passing by the residential area.
6. Commercial activities should not be permitted in residential area and silence area.
7. Houses should not be preferable located near the main road. Attention should be given to the architectural layout of residential localities so as to reduce the travel of noise from one house to another.
8. There should be plenty of trees and bushes in open space between houses and roads.
9. Use of loud speaker should be reduced.
10. Playing of noise generating devices in houses should be preferable low volume.
11. Diesel generator sets and pumps used in multistoried buildings should have proper noise.
12. Houses should be located far away from the roads.

Noise at receiver end can be controlled by adopting hearing protector. The prime function of ear protector is to reduce the noise level at the wearers ears to within safe limits. The uses of ear plugs ear muffs are necessary. Attention must be given to hygiene discomfort and other medical problems that may arise through their use. Noise control can also be done by treatment of noise path. In this some barriers are placed in between the source and receiver. Use of sound absorbent in ordinary buildings should also be encouraged. 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. People Corporation, participation and awareness in the matter of environment, Eco-city planning and application of laws effectively may play important role in prevention and control of noise. Necessary preventive measures must be taken by the appropriate authority to implement the Noise pollution (Regulation and Control) Rules 2000 in time bound manner. Professionals, such as town planners, architect, and environmental engineers should have the problem of environmental noise pollution in mind when setting new roads, shopping center, schools, hospitals, and houses.

Preparation of noise maps for city is the one of most valuable step to decrease noise pollution in Jabalpur. Noise maps are very powerful tools for communicating result of assessment of environmental noise to the general public and for the government (local and national) to devise noise correction measure. The noise map itself, with the values of descriptors, provides baseline data for planner, engineers and other professional and researcher for the planning and execution of their projects.

At last it can be concluded that this issue can be resolved if people become aware of long term ill effects of noise pollution.

As it is a short term assessment of noise pollution problems in the town, further study may also be required to address the effect of noise pollution in the Jabalpur city.

6.2 Future Scope

1. At present work it was used limited location i.e 8 it may be considered some more location of different zone for better noise map of the city.
2. As it is a short term assessment of noise pollution problems in the town, further study may also be required to address the chronic effect of noise pollution in the Indore city.
3. Traffic noise is the main source of noise pollution in Indore city. study for remedial measures to be determined in the heavy traffic zone is required.
4. Study of noise pollution during Festivals like Ganeshotsava, Dashera

and Diwali can also be studied as noise level increases during these seasons.

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