

Noise Pollution at Selected Junctions of Vadodara City from Vehicular Traffic

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ABSTRACT: Noise pollution can be defined as the unwanted sound that is released to the environment and disturbing the human beings. Sources of noise pollution include industrial sources, non-industrial sources, vehicles, uncontrolled use of loud speakers, construction activities such as drilling, etc. Noise levels from vehicles through engines and horns are the main cause of concern in cities and may potentially contribute about 60% of total noise pollution. An attempt was made to measure noise levels emanating from vehicles on selected intersection of Vadodara city. These are major intersection that witness heavy traffic during peak and non-peak hours. Traffic volume and noise levels were measured at various junctions on these roads during peak and non-peak hours. The study also includes remedial measures that can be implemented to reduce the noise levels.

KEYWORDS: Noise, Pollution, Traffic, Decibels, Environment.

I. INTRODUCTION

In India, transportation demand in urban areas continues to increase rapidly as a result of both population growth and changes in travel patterns. During the first decade of the 21st century only, the urban areas in the country confront a historic transportation crisis that has become a planning war against increasing mobility gridlock and noise pollution. Fast growing vehicle population in town in the recent years, has resulted in considerable increase in traffic on roads causing alarming noise pollution, air pollution. Noise level increases with traffic volume in an exponential manner. In India like many other developing countries traffic noise is major continents of environmental pollution and now it has become a permanent part of urban and sub-urban life. It is very harmful to human beings. In the new millennium, for protection environmental degradation it is imperative to pay greater attention towards measuring noise pollution, enforcing regulation for noise emission limits, elimination and control noise pollution.

Traffic related noise pollution accounts for nearly two-third of the total noise pollution in an urban area. Traffic noise on existing urban road-ways lowers the quality of life and property values for person residing in vicinity of these urban corridors. So the present study was carried out to analyze the present state of noise pollution in three major roads of the Vadodara city & to suggest proper measures to reduce the noise within permissible limits.

Study area profile: Vadodara is located at 22.30°N 73.19°E in western India at an elevation of 39 metres (128 ft). It is the 18th largest city in India with an area of 235 square kilometres (91 sq mi) and a population of 2.1 million according to the 2010–11 census. The city sits on the banks of the Vishwamitri River, in central Gujarat. According to the Bureau of Indian Standards, the cosmopolis falls under seismic zone-III, in a scale of I to V (in order of increasing proneness to earthquakes). Vadodara is divided by the Vishwamitri into two physically distinct eastern and western regions. The eastern bank of the river houses the old city, which includes the old fortified city of Vadodara. This part of Vadodara is characterised by packed bazaars, the clustered and barricaded Pol system of shanty buildings, and numerous places of worship. It houses the General Post Office and landmark buildings like Laxmi Vilas Palace, Mandvi area and Nyay Mandir. The colonial period saw the expansion of the city on the western side of Vishwamitri. This part of the city houses educational institutions such as the Maharaja Sayajirao University of Baroda (M.S.U.), the Vadodara Railway Station, modern buildings, well-planned residential areas, shopping malls, multiplexes and new business districts.

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Vehicular growth of Vadodara city:

Mandavi is located in the heart of Vadodara city and is surrounded by major roads that house both residential and commercial establishments. Thousands of vehicles ply on these roads every day. Vehicular traffic creates noise (through engine and honking) and these roads are no exception. It was therefore proposed to measure noise levels around the college within a radius of two kilometers at selected junctions where there would be heavy traffic. This project was taken up as a preliminary study. Vehicles are the main source of noise in cities and may contribute to about 60% of total noise pollution. Noise pollution is measured in the unit of decibels (dB). When noise is above 45 dB, it will affect the sleep patterns in human beings. At 120 dB, there is a potential for pain in the ears (the noise level of an ambulance siren is about 90-95 dB). Poor urban planning gives way for noise pollution. There is direct link between noise and health. Noise pollution can cause high blood pressure, lack of concentration, stress, and sleep disruption.

Government of India has developed standards² for the noise levels covering different areas. The standards are shown in the table below:

Table 1 – CPCB Standards with respect to Noise in Ambient Air

Area Code	Category of Area	Limits in dB	
		Day Time	Night Time
(A)	Industrial Area	75	70
(B)	Commercial Area	65	55
(C)	Residential Area	55	45
(D)	Silence Zone	50	40

Ref. Published in the Gazette of India, Extraordinary, Pt.II, Sec. 3 (ii) dated 14th February, 2014.

Day Time is reckoned in between 6 a.m. and 10 p.m. and Night Time is reckoned between 10 p.m. and 6 a.m.

Note: Silence zone is an area comprising not less than 100 metres around hospitals, educational institutions, courts, religious places or any other area which is declared as such by the competent authority.

ROAD TRAFFIC NOISE & IT'S EFFECT:

Road traffic noise is the most important major source of community noise especially near an important road with high volume of traffic of any major city. In developing country like India where Roads are in bad condition, and poorly maintained and has considerable number of vehicles of outdated technology, the road traffic noise assumes much more importance.

Factors effecting traffic noise:

(i) Type of traffic flow speed, as the traffic flow increase, the noise level increases. Higher speed also causes higher noise levels. At lower speeds, the influence of engine transmission of noise is predominant on the other hand at higher speed the tyre surface interaction assumes importance. Noise level increases during acceleration.

(ii) Tyre-road surface interaction: It is a major generator of noise Grooved cement concrete pavement is found to be source of annoying noise to neighbourhood.

(iii) Road surface condition: Smooth surface generally produce less noise. Rough surface and poorly maintained road with pot-holes produce more noise.

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 4, April 2016

(iv) The noise generated by various parts of vehicle: Important Sources are , Engine Inlet Exhaust , propulsion & transmission including gears, brakes, horns, chasis body structure, Load in vehicle, door slamming etc. Further as the vehicle grow older and their mechanical condition deteriorate the noise generated in more.

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Factors influencing road traffic noise generation:

Individual vehicle noise is a combination of noises produced by:

- the engine;
- the horn;
- the interaction of tyres and road pavement;
- body and load rattles.

At lower traffic speeds (typically less than 60km/hr), engine and exhaust noise tend to dominate. Tyre noise is a component of vehicle noise which significantly increases with speed. Studies suggest that at speeds between 30 and 50 km/hr, tyre noise of cars increases to a level which dominates the overall vehicle noise. For trucks, this 'cross-over' point tends to occur between 40 and 80 km/hr.

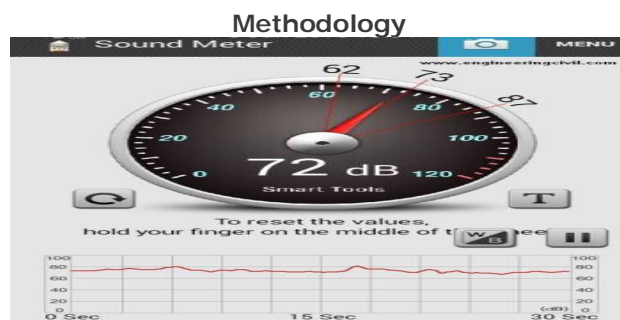


Figure 1 *Sound Level Meter Lite*

The traffic survey was performed at each junction taking four fifteen minute counts. The sound level meter was held at a height of three and a half feet above the road level as suggested by Central Road Research Institute³. The microphone was covered with a foam cover to prevent any dust or wind damage and was pre calibrated. *Sound Level Meter Lite (version 1.6.1)* was used for noise level measurements. The team members counted the vehicles. A map (figure 2) was created indicating the locations of the measurements. Vehicular count for 2-wheelers, auto-rickshaws, cars/vans/jeeps/SUVs and buses / trucks (since their numbers are low) were taken and tabulated to get the total. The noise level surveys were carried out at the 10 junctions as shown in Figure 2 for both peak and non-peak hours.

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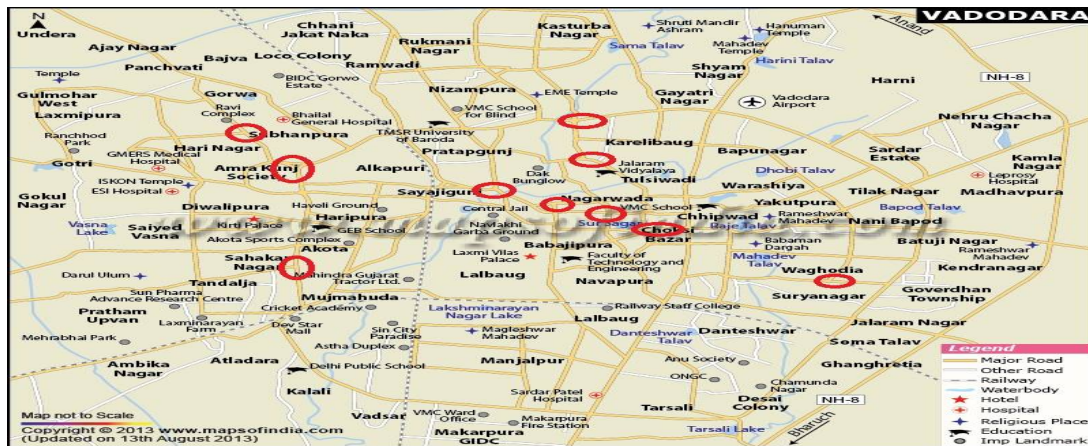


Figure 2 Traffic Junctions

II. COLLECTION

Table 2 Change in Noise Levels between Peak and Non-Peak Hours

Location	Peak	Non-Peak	% Change
Mandvi Jn.	80.6	70.1	15.00%
Jubilee baugh*	76.1	76.6	-0.70%
Nyaymandir Jn.	78.3	71.4	9.70%
Malhar Point Jn.*	77	82.3	-6.40%
Race course Jn.	79.4	75.4	5.30%
Subhanpura . Jn.	79.6	75.8	5.00%
Raopura Tower Jn.	76.7	72.2	6.20%
Sardar Estate Jn.	78.4	77.4	1.30%
Vrundavan Jn. *	77.7	78.2	-0.60%
Abhilasha Jn.*	76	77.2	-1.60%

* Indicates that the noise level is higher during non-peak hours than peak hours

An interesting observation was made as there was a variation in noise levels at a traffic signal. When the green light turned to red, the noise level decreases and remained constant for a while before increasing when the amber to green light transition was in the process. This was due to the horns and revving up of engines.

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 4, April 2016

Table 3 Traffic volume for Peak Hours

Location / Vehicle Type	2 wheelers	Autos	Cars/Vans/Jeeps/SUVs	Buses/Trucks	Total
Mandvi Jn.	2,090	460	1,401	164	4,115
Jubilee baugh	1,603	312	1,408	63	3,386
Nyaymandir Jn.	2,285	554	1,872	112	4,823
Malhar Point Jn.	2,238	628	1,303	290	4,459
Race course Jn.	2,754	281	780	35	3,850
Subhanpura . Jn.	2,463	354	920	24	3,761
Raopura Tower Jn.	2,235	1,206	1,069	75	4,585
Sardar Estate Jn.	1,694	481	709	170	3,054
Vrundavan Jn.	1,325	447	491	77	2,340
Abhilasha Jn.	1,108	267	503	51	1,929

Table 4 Traffic volume for Non-Peak Hours

Location /Vehicle Type	2 wheelers	Autos	Cars/Vans /Jeeps/ SUVs	Buses/ Trucks	Total
Mandvi Jn.	1,642	503	851	249	3,245
Jubilee baugh	1,251	295	981	59	2,586
Nyaymandir Jn.	2,346	701	2,246	277	5,570
Malhar Point Jn.	1,870	676	1,208	160	3,914
Race course Jn.	1,109	506	675	118	2,408
Subhanpura . Jn.	1,224	269	1,425	22	2,940
Raopura Tower Jn.	1,329	492	1,066	83	2,970
Sardar Estate Jn.	1,443	453	686	167	2,749
Vrundavan Jn.	946	275	438	89	1,748
Abhilasha Jn.	735	268	435	55	1,493

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Vol. 5, Issue 4, April 2016

Figure 3 - Change in Noise Levels between Peak and Non-Peak Hours

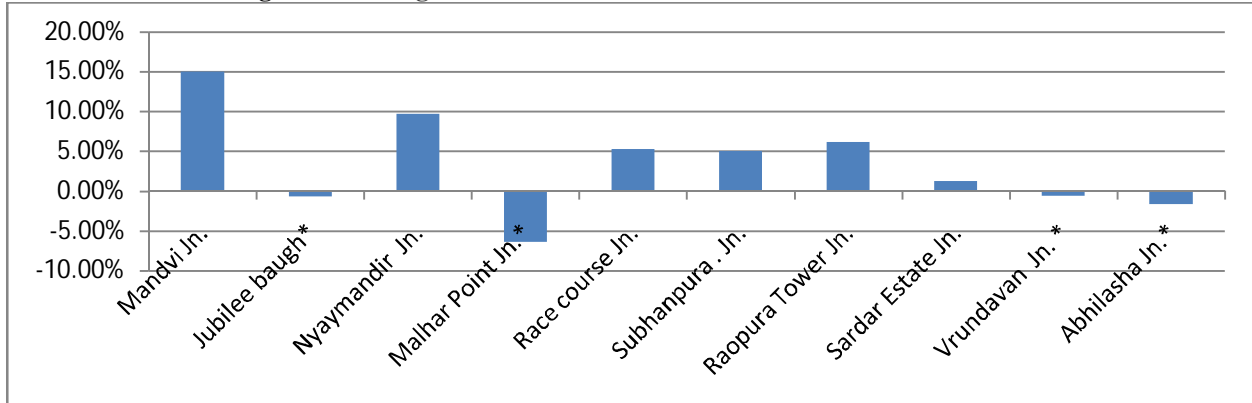
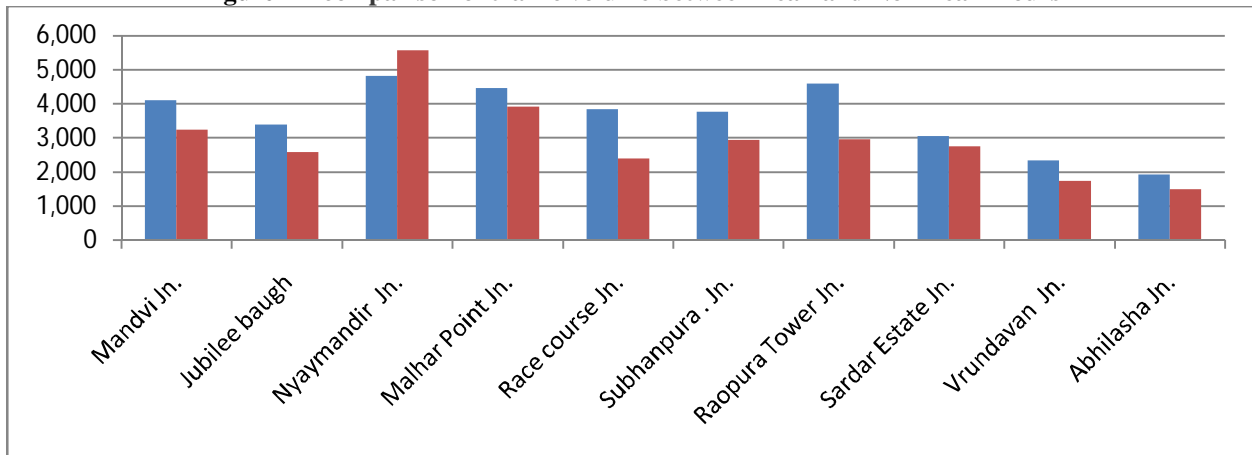


Figure 4 – comparison of traffic volume between Peak and Non-Peak Hours



III.RESULTS

Tables 2 to 4 show the noise levels (dB) and the traffic volume measured for 2-hour for both peak and non-peak hours. Figure 3 & 4 shows the noise level (in dB) in relation to the time (60 minutes) for each location for peak and non-peak hours. On the expected lines, the traffic volume was higher during peak hours as compared to non-peak hours except for the Nyaymandir Jn.. The results for each location are discussed below:

1. Mandvi Jn.

Old centre of Vadodara city, nearby some famous shopping streets. Hence the maximum noise level can easily exceed 80dB. Average noise level for 1-hour during peak time was 80 dB and for non-peak times it was 70 dB. The peak hour noise level is higher than the non-peak hour though the number of vehicles is higher for peak hour.

2. Jubilee baugh

Centre of Vadodara city, near Gandhi Nagar Gruh lord Buddha statue. Hence the maximum noise level can easily exceed 80dB. Average noise level for 1-hour during peak time was 76 dB and for non-peak times it was 76 dB. The peak hour noise level is almost same as the non-peak hour due to CBD area though the number of vehicles is higher for peak hour.

3. Nyaymandir Jn.

Centre of Vadodara city, the building complex in centre of the city has court and other related offices. The maximum noise level can easily exceed 80dB. Average noise level for 1-hour during peak time was 78 dB and for non-peak time

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 4, April 2016

it was 71 dB. The peak hour noise level is higher than the non-peak hour though the number of vehicles is higher for non-peak hour due to the centre of city and surrounded by public offices and court.

4. Malhar Point Jn.

New business centre at Old Padara road of Vadodara. Due to this the maximum noise level can easily exceed 80dB. Average noise level for 1-hour during peak time was 77dB and for non-peak time it was 82.3dB. The non-peak hour noise level is higher than the peak hour though the number of vehicles is higher for peak hour. It is due to truck traffic which is banned during peak hours.

5. Race course Jn.

New business centre with government and private offices is creating heavy traffic rush in this area, it is connected way to the station and northern parts of Vadodara city. Average noise level for 1-hour during peak time was 79 dB and for non-peak time it was 75 dB. The peak hour noise level is higher than the non-peak hour though the number of vehicles is higher for peak hour.

6. Subhanpura . Jn.

It is connected road of residential, commercial, industrial area with heavy traffic flow. Average noise level for 1-hour during peak time was 79 dB and for non-peak time it was 75 dB. The peak hour noise level is higher than the non-peak hour though the number of vehicles is higher for peak hour.

7. Raopura Tower Jn.

It is located near the centre of the city and connected road between centre and station area with government, residential and shopping area. Average noise level for 1-hour during peak time was 76 dB and for non-peak time it was 72 dB. The peak hour noise level is higher than the non-peak hour though the number of vehicles is higher for peak hour.

8. Sardar Estate Jn.

It is well known industrial area of Vadodara city and part of GIDC with slum area and residential area also. Average noise level for 1-hour during peak time was 78 dB and for non-peak time it was 78 dB. The peak hour noise level is slightly higher than the non-peak hour though the number of vehicles is higher for peak hour.

9. Vrundavan Jn.

It is well known point at southern side of city located at waghodiya road, mainly some shopping and residential area. Average noise level for 1-hour during peak time was 77 dB and for non-peak time it was 78 dB. The non-peak hour noise level is slightly higher than the peak hour though the number of vehicles is higher for peak hour this is due to location near to the national highway bypass.

10. Abhilasha Jn.

It is well known labour pick up points of vadodara city located at Sama road. Average noise level for 1-hour during peak time was 76 dB and for non-peak time it was 77 dB. The non-peak hour noise level is slightly higher than the peak hour though the number of vehicles is higher for peak hour this is due to labour pick up point and residential area.

IV. CONCLUSIONS

Based on the experimental investigation, the following conclusions were drawn:

- 1) Peak hours (approximately 9.00 a.m – 11.00 a.m) were as predicted produced more noise in most cases when compared to non-peak hours (11.30 a.m – 4.00 p.m). Except for four locations (as shown in table 2), the noise levels reduced during non-peak hours.
- 2) The highest decibel level was found at Malhar Point Jn. with 82.3dB during non-peak hours.
- 3) The lowest decibel level was found at Mandvi Jn. with a noise level of 70.1 dB during non-peak hours.
- 4) The noise levels at Jubilee baugh were high. The average noise level during peak hour was 76.6 dB and it was 76.1 dB during non-peak hour.

International Journal of Innovative Research in Science, Engineering and Technology

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Vol. 5, Issue 4, April 2016

V. REMEDIAL SOLUTIONS

Some possible solutions to reduce noise pollution are:

1. Enforcement – Increase enforcement through deployment of more number of traffic police on the roads to check on vehicle noise. Irregular and unnecessary use of pressure horns by the drivers of truck, bus and other automobiles should be checked. Punishment should be provided for the non-use of silencers and proper horns.
2. Noise barriers- They are solid obstructions built between the highway and the homes along the highway. Effective noise barriers can reduce the noise levels by 10-15 decibels, cutting the loudness of the traffic in half. Barriers can be formed from earth mounds along the road (usually called earth beams) or from high, vertical walls. Earth beams have a natural appearance and are usually attractive.
3. Spreading public awareness regarding noise pollution and its effects through media such as TV, internet, newspaper, radio, etc. Educate drivers to reduce honking.
4. Vegetation – If the height and width of the tree and density of the foliage is optimal, it can prevent noise pollution to a large extent. 200 feet width of dense vegetation can reduce noise by 10 decibels.
5. Removing the words “SOUND OK HORN” on the back of the vehicles.
6. Signboards – Banning use of horns in silence zones. Install big signboards indicating silence zones and fines that would be levied for honking.
7. Noise levels of motor vehicles and construction equipment, aircraft should be standardized. Railway track should not pass through residential areas especially for shunting and aerodromes should be constructed far away from the residential areas. Landing charges on noisy aircrafts or rebates of landing charges to quiet aircraft. Provision should be made in the Act regarding the limit of noise in terms of decibels, as is done in most of the country.

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