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# Noise Level Study in North-Central Region of Vadodara City in Gujarat

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**Abstract:** ***Molecules vibration creates sound and it can pass through any substance whether it is a solid, liquid or gas but vacuum has no molecules, and that's the reason, the sound cannot travel through. Noise pollution is displeasing human, animal or machine created sound that disturbs the activity or balance of human and animal life. Vadodara is the 3rd largest city of Gujarat after Surat and Ahmadabad having estimated population of 18 lakhs .Due to increasing population and industrialization, the transportation in the city has increased to un-imaginary highs and causes want of efficient mass transfer system. The increased vehicular numbers on existing roads has considerably pushed traffic to create noise that adversely affects the human beings and living creatures. In the present study efforts were made to study the noise levels at different locations by using sound level meter so that the negative aspects of harsh sound can be mitigated. The collected data will be analyzed to know the traffic behavior and characteristics of various roads and location of the Northen-Central region of Vadodara city like hospitals, school, library, office's and residences etc. and then the maximum noise level will be estimated.***

**Keywords**: Noise level, Sound, Population, Traffic behavior, dBa)

## Introduction

Noise can be defined as the level of sound which exceeds the acceptable level and creates annoyance. Frequent exposure to high level of noise causes severe stress on the auditory and nervous system. Extended exposure to excessive sound has proved physical and psychological damage. Because of its annoyance and disturbance implications, noise adds to mental stress and hence affects the general well-being of those exposed to it. Noise is a major source of friction among individuals. The major sources of noise are Industrial noise, traffic noise & community noise. Out of the above three parameters, the source that affects the most is traffic noise. In traffic noise, almost 70% of noise is contributed by the vehicles. Vehicle noise is created by engine and exhaust system of vehicles, aerodynamic friction, interaction between the vehicle and road system, and by the interaction among vehicles.

At certain levels and durations of exposure, it can cause physical damage to the eardrum and results in temporary or permanent hearing loss. Hearing loss does not usually occur at SPLs below 80 dBA (eight-hour exposure levels are best kept below 85 dBA), but most people repeatedly exposed to more than 105 dBA will have permanent hearing loss to some extent. In addition to causing hearing loss, excessive noise exposure can also raise blood pressure and pulse rates, cause irritability, anxiety, and mental fatigue, and interfere with sleep, recreation, and personal communication. Noise pollution control is therefore of importance in the workplace and in the community. Noise-control ordinances and laws enacted at the local, regional, and national levels can be effective in mitigating the adverse effects of noise pollution. Homes, schools, offices, hospitals, commercial business centers, and other community buildings were routinely built close to the main roads of the municipality without buffer zones or adequate sound proofing. The problem has been compounded by increases in traffic volumes (two wheelers, heavy motor vehicles, and other vehicles) far beyond the expectations of our early urban planners. This alarming increase in the volume of traffic is actually inversely related to the degradation of the environment. Noise pollution is one of the major environmental pollutants that are encountered in daily life and has direct effects on human performance. Sound pressure is a basic measure of the vibrations of air that makes up sound, and because the range that the human listeners can detect is very wide, these levels are measured on the logarithmic scale with units of decibel (dB). Vadodara city of Gujarat, is a relatively medium-large urban city, situated in the western region of India, is located at 22.3000° N, 73.2003° E. As per 2011 census, the population of vadodara city has exceeded 1.8 million (vadodara Municipality Statistics, provided by the VMC at the Government of Gujarat website.

All transportation systems create noise pollution. With residences created adjacent to factories, they experience noise pollution and its adverse effects. Besides transportation noise, noise can come from factory appliances, power tools and audio entertainment systems.
Measures of noise: Noise pollution is measured in decibels. When noise is at 45 decibels, no human being can sleep, and at 120 decibels the ear is in pain and hearing begins to be damaged at 85 decibels.

**Table 1:** The magnitude of noise levels from some common noise sources.

| Serial No. | Type of Source of Noise | Noise Level in Decibel |
|---|---|---|
| 1 | Light Road Traffic (Side Streets) | 60 -70 |

| | | |
|---|---|---|
| 2 | Medium Road Traffic Streets) | 70-80 |
| 3 | Heavy Road Traffic (Highways) | 80-90 |
| 4 | Rail Traffic | 90-110 |
| 5 | Air Traffic | 90-110 |

Broadly speaking, the noise pollution has two sources, i.e. industrial and non- industrial. The industrial source includes the noise from various industries and big machines working at a very high speed and high noise intensity. Non- industrial source of noise includes the noise created by transport/vehicular traffic and the neighborhood noise generated by various noise pollution can also be divided in the categories, namely, natural and manmade.
Most leading noise sources will fall into the following categories: roads traffic, aircraft, railroads, construction, industry, noise in buildings, and consumer products

1. Road Traffic Noise.
2. Air Craft Noise.
3. Noise from railroads.
4. Construction Noise.
5. Noise in Industry.
6. Noise in building.
7. Noise from Consumer product

This study was undertaken with the following specific objectives:

- To study the existing status of noise levels in the study area by recording the noise intensity at various locations.
- Identification and consideration of suitable mitigation and abatement measures.

## 2. Methods & Materials

In the present study, attempts were made to study the noise level range at south-west region of Vadodara city. Traffic behavior and characteristics at various places like schools, hospitals, offices, courts, etc. was recorded using the sound measuring instrument "Sound Level Meter". Then, the maximum value of noise level in decibels was taken and suggestions were given for reducing the noise pollution. For this nine major locations of Vadodara city were taken for study purpose which faces major traffic as well as noise pollution. Traffic survey was also carried out for these nine locations. The methodology adopted in this project has been shown below through the Flow-chart.

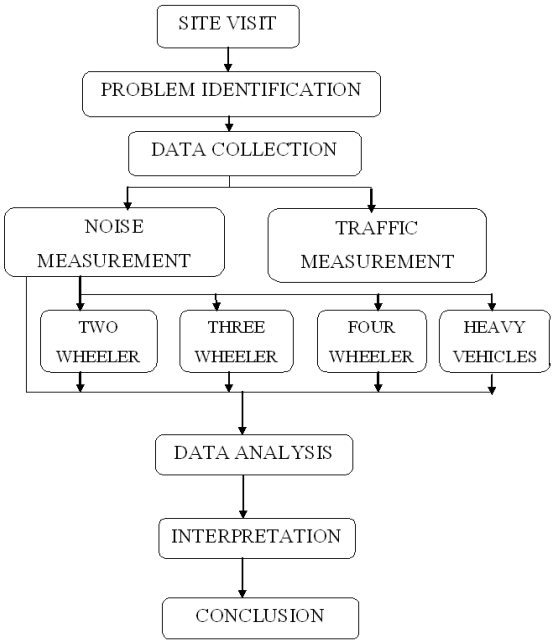


**Figure 1:** Flowchart of Methodology adopted

The Nine areas selected for study purpose were M.S.University, Sama, S.S.G. Hospital, Gotri, Nyaymandir, Gorwa, Karelibagh, Subhanpura & Alkapuri.. The Traffic density and sound level measurement were shown in below table

**Table 2:** Sound level Measurement at 9:00 to 11:00 A.M at All Nine Location

| TIME | 9:00-9:15 | 9:15-9:30 | 9:30-9:45 | 9:45-10:00 | 10:00-10:15 | 10:15-10:30 | 10:30-10:45 | 10:45-11:00 | AVG. |
|---|---|---|---|---|---|---|---|---|---|
| MSU | 75.38 | 75.86 | 79.1 | 78.86 | 77.18 | 77.1 | 76.67 | 77.16 | 77.16 |
| SAMA | 75.23 | 78.21 | 71.28 | 72.47 | 76.35 | 72.89 | 71.46 | 75.77 | 74.21 |
| SSG HOSPITAL | 77.1 | 71.35 | 75.81 | 75.58 | 76.18 | 76.06 | 74.97 | 74.95 | 75.54 |
| GOTRI | 72.06 | 71.32 | 70.59 | 70.34 | 73.4 | 71.89 | 71.36 | 71.88 | 71.61 |
| NYAYMANDIR | 75.6 | 79.5 | 75.5 | 76.8 | 75.2 | 79.2 | 76.5 | 74.2 | 76.56 |
| GORWA | 73.66 | 79.13 | 77.84 | 74.15 | 74.52 | 73.74 | 74.78 | 74.62 | 75.31 |
| KARELI BAGH | 72.39 | 74.4 | 70.29 | 71.22 | 72.42 | 72.23 | 71.64 | 71.2 | 70.19 |
| SUBHANPURA | 71.45 | 72.56 | 72.43 | 70.67 | 69.93 | 71.46 | 71.78 | 71.23 | 71.44 |
| ALKAPURI | 72.56 | 71.23 | 70.46 | 74.69 | 73.98 | 71.23 | 72.49 | 70.15 | 72.1 |

**Table 3:** Sound level Measurement at 1:00 to 3:00 P.M at All Nine Location

| TIME | 1:00-1:15 | 1:15-1:30 | 1:30-1:45 | 1:45-2:00 | 2:00-2:15 | 2:15-2:30 | 2:30-2:45 | 2:45-3:00 | AVG. |
|---|---|---|---|---|---|---|---|---|---|
| MSU | 76.52 | 76.16 | 71.19 | 70.28 | 74.43 | 74.59 | 77.7 | 72.1 | 74.12 |
| SAMA | 75.94 | 69.25 | 75.23 | 70.99 | 70.26 | 71.2 | 69.99 | 68.23 | 71.39 |
| SSG HOSPITAL | 78.21 | 71.2 | 71.36 | 71.25 | 72.5 | 72.39 | 73.5 | 75.23 | 73.21 |
| GOTRI | 69.3 | 62.1 | 72.7 | 68.3 | 71.5 | 67.2 | 65.2 | 73.1 | 68.68 |
| NYAYMANDIR | 80.05 | 76.4 | 76.3 | 78.9 | 75.6 | 72.5 | 71.2 | 76.5 | 75.93 |
| GORWA | 72.31 | 71.52 | 72.65 | 72.3 | 72.94 | 72.23 | 71.49 | 74.1 | 72.44 |
| KARELI BAGH | 74.1 | 70.93 | 73.8 | 71.24 | 72.37 | 72.05 | 73.11 | 72.97 | 72.57 |
| SUBHANPURA | 70.46 | 71.23 | 69.65 | 69.46 | 68.79 | 70.79 | 69.69 | 71.36 | 70.18 |
| ALKAPURI | 69.93 | 70.39 | 70.49 | 71.23 | 70.69 | 71.72 | 70.86 | 70.56 | 70.73 |

**Table 4:** Sound level Measurement at 5:00 to 7:00 P.M at All Nine Location

| TIME | 5:00-5:15 | 5:15-5:30 | 5:30-5:45 | 5:45-6:00 | 6:00-6:15 | 6:15-6:30 | 6:30-6:45 | 6:45-7:00 | AVG. |
|---|---|---|---|---|---|---|---|---|---|
| MSU | 77.74 | 77.58 | 78.89 | 76.1 | 79.26 | 77.76 | 70.393 | 78.61 | 77.04 |
| SAMA | 71.68 | 79.38 | 71.59 | 75.26 | 73.4 | 78.27 | 74.72 | 72.82 | 74.64 |
| SSG HOSPITAL | 74.15 | 74.93 | 71.52 | 75.6 | 78.81 | 79.68 | 78.3 | 67.76 | 75.09 |
| GOTRI | 72.34 | 74.31 | 77.94 | 74.29 | 74.33 | 74.22 | 74.13 | 78.01 | 74.95 |
| NYAYMANDIR | 70.08 | 69.8 | 75.3 | 78.9 | 73.94 | 76.78 | 76.8 | 80.5 | 75.26 |
| GORWA | 74.58 | 74.4 | 73.65 | 71.62 | 75.14 | 76.6 | 81.6 | 77.3 | 75.61 |
| KARELI BAGH | 74.47 | 75.46 | 73.56 | 74.56 | 76.73 | 76.36 | 85.19 | 76.5 | 76.6 |
| SUBHANPURA | 74.65 | 75.89 | 74.76 | 74.56 | 78.44 | 75.64 | 74.82 | 75.49 | 75.53 |
| ALKAPURI | 74.23 | 74.89 | 73.46 | 76.51 | 74.36 | 75.79 | 74.49 | 78.11 | 75.23 |

**Table 5:** Traffic Density measured for peak hours of Gotri Road near M.E.R.S. Medical College

| VEHICLE | **9:00 to 9:15** | **9:15 to 9:30** | **9:30 to 9:45** | **9:45 to 10:00** | **10:00 to 10:15** | **10:15 to 10:30** | **10:30 to 10:45** | **10:45 to 11:00** |
|---|---|---|---|---|---|---|---|---|
| 2 Wheelers | 584 | 791 | 676 | 681 | 731 | 681 | 761 | 658 |
| 3 Wheelers | 150 | 177 | 153 | 134 | 135 | 139 | 97 | 98 |
| 4 Wheelers | 101 | 90 | 109 | 102 | 85 | 104 | 101 | 121 |
| Heavy Vehicles | 5 | 2 | 3 | 3 | 5 | 3 | 4 | 5 |
| Vehicle | **1:00 to 1:15** | **1:15 to 1:30** | **1:30 to 1:45** | **1:45 to 2:00** | **2:00 to 2:15** | **2:15 to 2:30** | **2:30 to 2:45** | **2:45 to 3:00** |
| 2 Wheelers | 572 | 546 | 521 | 582 | 523 | 541 | 531 | 583 |
| 3 Wheelers | 145 | 156 | 124 | 154 | 123 | 158 | 154 | 159 |
| 4 Wheelers | 103 | 82 | 87 | 83 | 91 | 97 | 94 | 98 |
| Heavy Vehicles | 2 | 5 | 6 | 4 | 3 | 10 | 2 | 7 |
| Vehicle | **5:00 to 5:15** | **5:15 to 5:30** | **5:30 to 5:45** | **5:45 to 6:00** | **6:00 to 6:15** | **6:15 to 6:30** | **6:30 to 6:45** | **6:45 to 7:00** |
| 2 Wheelers | 597 | 604 | 590 | 593 | 681 | 672 | 624 | 621 |
| 3 Wheelers | 163 | 193 | 178 | 176 | 178 | 166 | 176 | 164 |
| 4 Wheelers | 113 | 132 | 144 | 144 | 132 | 125 | 120 | 134 |
| Heavy Vehicles | 4 | 6 | 1 | 1 | 10 | 10 | 9 | 5 |

**Table 6:** Traffic Density measured for peak hours of Civil Road near S.S.G. Hospital

| Vehicle | 9:00 to 9:15 | 9:15 to 9:30 | 9:30 to 9:45 | 9:45 to 10:00 | 10:00 to 10:15 | 10:15 to 10:30 | 10:30 to 10:45 | 10:45 to 11:00 |
|---|---|---|---|---|---|---|---|---|
| 2 Wheelers | 613 | 821 | 853 | 889 | 573 | 651 | 886 | 948 |
| 3 Wheelers | 227 | 223 | 192 | 214 | 205 | 234 | 268 | 368 |
| 4 Wheelers | 110 | 230 | 115 | 117 | 115 | 203 | 148 | 120 |
| Heavy Vehicles | 18 | 17 | 25 | 20 | 29 | 30 | 24 | 21 |
| Vehicle | 1:00 to 1:15 | 1:15 to 1:30 | 1:30 to 1:45 | 1:45 to 2:00 | 2:00 to 2:15 | 2:15 to 2:30 | 2:30 to 2:45 | 2:45 to 3:00 |
| 2 Wheelers | 592 | 621 | 584 | 586 | 623 | 645 | 621 | 628 |
| 3 Wheelers | 215 | 198 | 245 | 236 | 256 | 218 | 239 | 215 |
| 4 Wheelers | 124 | 123 | 154 | 112 | 114 | 124 | 142 | 113 |
| Heavy Vehicles | 22 | 28 | 24 | 21 | 26 | 24 | 25 | 23 |
| Vehicle | 5:00 to 5:15 | 5:15 to 5:30 | 5:30 to 5:45 | 5:45 to 6:00 | 6:00 to 6:15 | 6:15 to 6:30 | 6:30 to 6:45 | 6:45 to 7:00 |
| 2 Wheelers | 831 | 1086 | 817 | 890 | 1154 | 908 | 952 | 854 |
| 3 Wheelers | 254 | 256 | 279 | 124 | 308 | 277 | 212 | 288 |
| 4 Wheelers | 134 | 120 | 136 | 212 | 199 | 177 | 175 | 169 |
| Heavy Vehicles | 26 | 26 | 28 | 23 | 24 | 25 | 29 | 12 |

Same way traffic density for remaining all seven location were measured for peak hours

## 3. Results and Discussion

After completing the site inspection, traffic survey & Noise level measurement data were collected for peak hours and data were analyzed. Noise measurements were carried out using sound level meter. Number of sound level meter used was 1. The SPL data were collected in interval of 5minutes at 9 stations. The measurements have been carried out during peak hours.

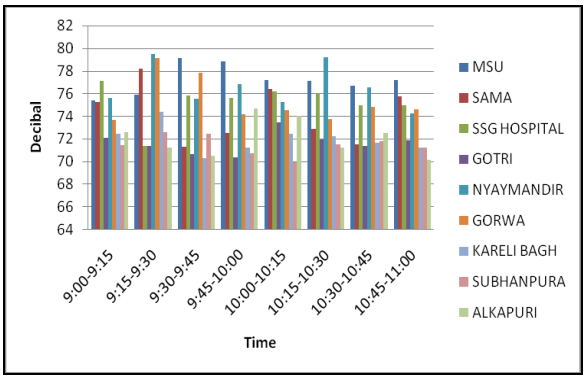


**Figure 2:** Time (minutes) v/s Sound pressure level (db) from 9:00 to 11:00 A.M.

Here survey is conducted in time duration 9.00am to 11.00am. From the above survey conducted it is observed that the sound pressure level is maximum i.e., 79.5 dB at Nyay Mandir near Sursagar Lake at 9.30 am.

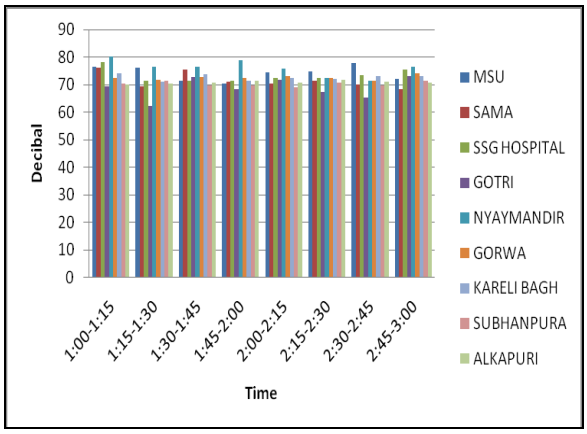


**Figure 3:** Time (minutes) v/s Sound pressure level (db) from 1:00 to 3:00 P.M.

Here survey is conducted in time duration 1.00 pm to 3.00 pm. From the above survey conducted it is observed that the sound pressure level is maximum i.e., 80.5 dB at Nyay Mandir near Sursagar Lake at 1.15 pm.

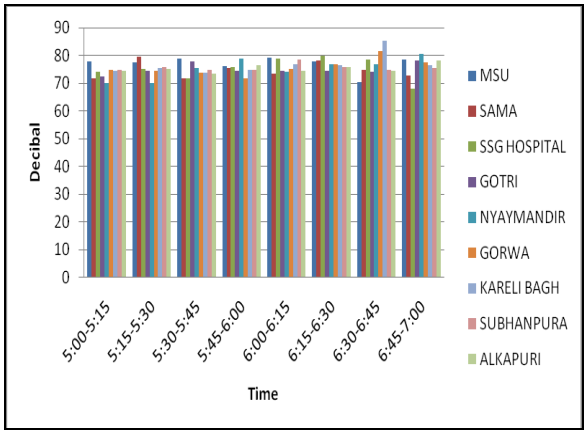


**Figure 4**: Time (minutes) v/s Sound pressure level (db) from 5:00 to 7:00 P.M.

Here survey was conducted between 5.00 pm to 7.00 pm. From the above survey, it was observed that the sound pressure level is maximum i.e., 85.19 dB at Karelibagh near Dev College at 6.45pm.

## 4. Remedial Measures

Nowadays health of people has become a great issue for us so that it is very necessary to control noise pollution .The acoustic ABC principles – "Absorb", "Block" "Cover" – are a useful way to consider reducing noise pollution. For example, sound can be *absorbed* by acoustic panels, single rooms *block* more noise than curtained multi-patient rooms, and acoustic sound masking *covers* noise with ambient sound. If all three elements are incorporated into healthcare design, many of the problems of noise pollution will be reduced, if not eliminated. The remedial measure for noise pollution can be broadly classified as control at source, control in the transmission path using protective equipments. The noise pollution can be controlled at the source of generation itself by reducing the noise levels from domestic sectors, maintenance of automobiles, control over vibrations, low voice speaking, and prohibition on usage of loud speakers and optimum selection of machinery, tools or equipment reduces excess noise levels. The noise pollution can be reduced during transmission path by vegetation, installation of barriers and design of the building incorporating the use of suitable noise absorbing material for wall/door/window/ceiling will reduce the noise levels. The usage of protective equipment and the worker's exposure to the high noise levels can be minimized by job rotation, exposure reduction, hearing protection, use of equipments like earmuffs, ear plugs etc. are the commonly used devices for hearing protection. Also strict enforcement of existing law to prohibit air horns inside the town, proper maintenance of the vehicles, laying good roads and their maintenance, Strict enforcement of the existing law to remove the encroachments on road sides, Plantation of trees like Neem and other vegetation inside the town on road sides and around the silence zone. Acoustic panels and other absorptive materials, door seals, low-reverb flooring and wall coverings can all assist in absorbing or blocking noise pollution. Educating people about the hazards of loud sound and restriction on the use of pressure horns, loud speakers and fire crackers shall play an important role in mitigating sound will reduce the noise levels.

## 5. Conclusion

Noise pollution is emerging as an environmental problem in Vadodara City and also other parts of India. This can cause negative impact on public health and welfare. Considering the above aspects, we can conclude that noise dominates the spectrum of environmental noise. The people staying in noisy area especially above 70 dB(A) should take precautionary measures in order to avoid noise induced hearing loss. This study has led to the following conclusions:

- The sources of noise pollution varied from places to place.
- The sound pressure level was maximum i.e., 85.19 dB at Karelibagh near Dev College at 6.45 pm.
- Mostly the sound pressure was maximum at Nayaymandir area Near Sursagar Lake.
- In all the places, above 70 db sound was recorded. Hence sound becomes physically painful.
- Traffic density was also high in peak hours at all the nine locations.
- Noise pollution has quantifiable negative effects on people. However acoustic sound masking and other acoustic treatments can eliminate or ameliorate these problems in a sustainable and cost effective manner. It is very essential to control noise at source, along the transmission path and at receivers end by using the remedial measures.

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