# NOISE POLLUTION MONITORING AND REMEDIES FOR HOSPITALS IN NASHIK CITY

Megha Aniruddha Ahire[1], Aakanksha Anil Burkul[2], Digvijay Kiran Shewale [3], Rutika Dharma Sonawane[4], Dr. K. L. Bidkar

[1] *Student, Civil Engineering Department, Sandip Institute of Technology and Research center, Nashik ,Maharashtra ,India.*
[2] *Student, Civil Engineering Department, Sandip Institute of Technology and Research center, Nashik ,Maharashtra ,India.*
[3] *Student, Civil Engineering Department, Sandip Institute of Technology and Research center, Nashik ,Maharashtra ,India.*
[4] *Student, Civil Engineering Department, Sandip Institute of Technology and Research center, Nashik ,Maharashtra ,India.*
[5]*Professor, Civil Engineering Department, Sandip Institute of Technology and Research center, Nashik ,Maharashtra ,India.*

**ABSTRACT**

*Rapid urbanization and alarming growth of population is causing serious environmental problems in Nashik city. Noise is one of the environmental problems that discomfort in daily life. Noise pollution has become major concern for communities living within the city. Major effects of noise pollution include interference with communication, sleeplessness, and reduced efficiency. The extreme effects e.g. deafness and mental breakdown neither is ruled out. Generally, a request to reduce or stop the noise is made out by the aggrieved party. However, complaints to the administration and police have also been accepted as a way of solving this menace. Noise levels can be effectively reduced by providing rooms for a single patient, by installing high- performance sound-absorbing acoustic ceiling tiles and by removing or reducing sources of loud noise in hospital units. In addition, acoustic ceiling tiles improve speech intelligibility by reducing sound reverberation and increase speech privacy by reducing sound propagation in adjacent areas. A large body of research also shows that music therapy is effective at reducing anxiety and distress in patients in many types of health care settings. In this project work, noise pollution monitoring of major hospitals ofNashik City will be done so as to identify the noise levels that could harm the patients in the hospitals which are most prone to noise pollution effects.*

**Keyword :** - *Noise pollution, Nashik City, Hospitals, Patients*

## 1. INTRODUCTION

Noise within the hospital environment is becoming more recognized. Health care organizations are expressing more concern for the well being of their patients. Health care organizations are also more cognizant of the hospital staff's work environment and are attempting to be more effective in meeting the needs of their patients. A significant concern that is becoming noticed, is the generation of noise in hospitals particularly, intensive care units.

Various sources such as, hospital equipment, monitor alarms, and phones, all of which can affect a patient's rest and recovery, may cause the increase in hospital noise level. Interventions such as, implementation of a noise abatement program and education of hospital staff are just a few programs that have been created to reduce noise and increase the overall patients' satisfaction. There is no doubt that the noise affects human health adversely. The noise may result in loss of hearing, stress, high-blood pressure, loss of sleep, distraction affecting productivity, and a general reduction in the quality of life. The effects of noise are difficult to quantify because tolerance levels among

different populace and types of noise vary considerably. There is a large amount of scientific literature assessing the effects of noise on human beings. Indiscriminate use of horn by the vehicles and wide spread use of loudspeakers in Indian social and religious ceremonies caused several health hazards to the urban inhabitants. It may cause deafness, nervous breakdown, mental disorder, heart troubles, high blood pressure, dizziness and insomnia. Exposure to noise pollution exceeding 75 decibels for more than eight hours daily for a long period of time can cause loss of hearing.
The percentage of highly sensitive areas at each facade using the following classification of the different hospital rooms depends on their sensitivity to noise and based on subjective criteria:

- Highly sensitive area: patient wards, dormitories in general, surgical and treatment areas.
- Moderately sensitive area: work areas, meaning those areas in which work is carried out that may be affected by high noise levels. This scale would include the offices of medical and administrative professionals, specialty consultations, laboratories and research centres, training rooms, etc.
- Less sensitive area: areas in which a high level of noise would not cause any harm to patients and professionals. This area would include cafeterias, canteens, warehouses, archives, rooms with air-conditioning facilities, public toilets, etc.

Various sources such as, hospital equipment, monitor alarms, and phones, all of which can affect a patient's rest and recovery, may cause the increase in hospital noise level. Previous research studies on noise stress the importance of patient satisfaction during length of stay in the hospitals. Interventions such as, implementation of a noise abatement program and education of hospital staff are just a few programs that have been created to reduce noise and increase the overall patients' satisfaction.

### 1.1 Noise Monitoring

The high level of sound should be stopped at places like workplace, educational institution, residential area, hospital etc. Young children and students, such as fast- moving activities; On any occasion, the use of fast-moving devices and equipment should be encouraged to not be included in etc. In order to access the impact of noise pollution, an Ambient Noise Level Monitoring Program is being initiated by Maharashtra Pollution Control Board in 27 Municipal Corporation across the state in 102 locations for a period of 24 hours. The survey is being conducted on 21st and 22nd February 2021 considering a working and a non-working day), as per CPCB protocol. It is also aimed at generating long term ambient noise level data and trend, at the identified locations, by repeating the monitoring survey every year, since 2007.

### 1.2 Noise level monitoring in Nashik

The study reveals comparing the laid down noise norms for respective zones (Industrial, Commercial, Residential or Silence)the noise levels are exceeded at many locations. The ever-increasing use of automobiles is a major cause of this pollution. People honk unnecessarily in the traffic and listen to loud music on the way which creates high levels of noise. Noise pollution is the most common problem faced by humans, thanks to various reasons that pushes many people to face health issues. Following standard measures can be helpful in the long term for both humans and the environment. The ultimate aim is to bring down the noise pollution for a better environment. There are many measures taken by the government and people to reduce the effect of noise pollution. Soundproof walls and windows are now being installed in many houses. Many flyovers in cities have soundproof walls to bring down the noise level to a nearby resident from vehicles running. As a responsible citizen, we must contribute towards brining down the noise pollution. Needless honking should be stopped and officials should fine people doing it heavily. Hospitals and schools are build in silent zone.There should be rules to avoid noise in residential and sensitive areas. It is important for people to be aware of health Hazard from noise pollution. One of the best ways to bring down the noise pollution is by planting more and more plants. This process of planting stress can help to reduce the travelling of noise from one place to another.

## 2. LITERATURE REVIEW

***(Pathak, et al., 2015)***The study examines the problem of noise pollution in the wake of its ill effect on the life of the people. A cross-section survey of the population in Nasik city points out that main sources of noise pollution

are loudspeakers and automobiles.The analysis of the readings at various zones shows that industrial zone is much more aware about the noise pollution and try to restrict it below specified limit but in case of commercial and silence zones where general public involves it is above the specified limit. It indicates the non-awareness about the causes and effects of noise pollution.

***(González, et al., 2019)*** A study of one of the main hospitals in the Extremadura region (Spain) is presented here to allow a global assessment of the acoustic impact of outdoor sound sources. Both long- and short-term measurements were carried out, and a software model was developed. The measured values exceed the World Health Organization reference value of 50 dBA for daytime and evening, and are even higher than the 55 dBA limit at which severe annoyance is generated.

***(Khademi, et al., 2011)*** The improvement of technology has increased noise levels in hospital Wards to higher than international standard levels (35-45 dB). Higher noise levels than the maximum level result in patient‘s instability and dissatisfaction. The research was based on the comparison of equalizing levels (Leq) because maximum levels were unstable. In their survey the average level (Leq) in all wards was much higher than the standard level. The maximum level (Lmax) in most wards was 85-86 dB and just in one measurement in the Internal ICU reached 94 dB. The average level of Leq in all wards was 60.2 dB. In emergency units, it was 62.2 dB, but it was not time related. The highest average level (Leq) was measured at 11:30 AM and the peak was measured in the Nephrology nursing station. The average levels of noise in intensive care units and also emergency wards were more than the standard levels and as it is known these wards have vital roles in treatment procedures, so more attention is needed in this area.

***(Khaiwal, et al., 2016)*** This paper aimed to map the noise pollution levels and to explore the self reported non-auditory effects of noise in a tertiary medical institute. Almost all the respondents (97%) regarded traffic as the major source of noise. About three-fourths (74%) reported irritation with loud noise whereas 40% of respondents reported headache due to noise. Less than one-third of respondents (29%) reported loss of sleep due to noise and 8% reported. hypertension, which could be related to the disturbance caused due to noise. Noise levels in and around the hospital was well above the permissible standards. The recent Global Burden of Disease highlights the increasing risk of non communicable diseases. The non-auditory effects studied in the current work add to the risk factors associated with non communicable diseases.

## 3. METHODOLOGY

**List of Major Hospitals in Nashik to be monitored:**

| | | | |
|---|---|---|---|
| **1.** | Curie Manavata Cancer Centre | **20.** | Shatabdi Hospital |
| **2.** | Dr. Lad‘s Navjeevan Hospital Pvt Ltd | **21** | Six Sigma Hospital |
| **3.** | Wockhardt Super Speciality Hospital | **22** | Sahyadri Speciality Hospital |
| **4.** | Manas Hospital | **23** | Sahara Hospital |
| **5.** | Sujata Birla Hospital & Medical Research Centre | **24** | Dr Mutha Hospital |
| **6.** | Life Care Hospital | **25** | Apollo Hospital (Panchavati) |
| **7.** | City Care Hospital | **26** | Nerlikar Hospital |
| **8.** | Sonawane Heart Care Hospital | **27** | Divyajyot Hospital |

| | | | |
|---|---|---|---|
| **9.** | Lokmanya Multispecialty and Accident Hospital | **28** | Criticare Childrens Hospital |
| **10.** | Muktai Hospital | **29** | Sopan Hospital |
| **11.** | Kaushalya Hospital & Research Centre | **30** | Shree Guruji Rugnalaya |
| **12.** | Shree Saibaba Heart Institute & Research Center | **31** | Ashwini Accident Multispeciality Hospital |
| **13.** | Jairam Hospital & Research Center Pvt Ltd | **32** | Suyog Hospital |
| **14.** | Bhagwati Superspeciality Endoscopy Hospital | **33** | Dr Bagul Hospital |
| **15.** | Sankalp Speciality Healthcare Private Limited | **34** | Ganorkar Hospital |
| **16.** | Vijan Hospital And Research Center | **35** | Ayush Hospital (Ashok Stambh) |
| **17.** | Shree Balaji Hospital & Research Centre Pvt Ltd | **36** | Sunrise Hospital |
| **18.** | Lele Hospital And Research Center Pvt Ltd | **37** | Vidya Vikas Hospital |
| **19.** | Nashik Road Multi Speciality Hospital | **38** | Suman Hospital |

### 3.1 Methodology and Instrumentation

Sound Level Meter is an instrument designed to respond in approximately the same way as the human ear and to give objective, reproducible measurements of sound pressure level. Sound level meter consist of a microphone, a processing unit and read-out unit. The microphone converts the sound signal to an equivalent electrical signal. There are many type of microphone like condenser microphone, electrets condenser, dynamic microphone, carbon microphone, piezoelectric microphone, fiber optic microphone, which is used for various purposes. The most suitable type of microphone for sound level meters is the condenser microphone, which combines precision with stability and reliability. The electrical signal produced by the microphone is quite small and so it is amplified by a preamplifier before being processed. Noise Monitoring System (NMS) is used for measuring real time noise stations can be managed easily using this technology. It comprises of microphone, data logger and mounting stand.

Noise Monitoring System (NMS) is used for measuring real time noise stations can be managed easily using this technology. NMSs are optimized for outdoor use with small, custom designed enclosure, and also designed for use in all climatic environments. NMS consist of a weatherproof cabinet containing a noise level analyzer and a battery, a communication device for transmitting data to receiving station, a back an outdoor microphone (for measuring sound) all of which can be mounted on a mast.

## 4. RESULTS AND DSICUSSIONS

According to IS specification noise level for silence zone area (hospitals) ranged between 40 dB to 50 dB. Such monitored noise levels can cause sleep disturbance, interfere with speech and may affect patient health and doctor‘s performance as they interfere with speech communication and message extraction. Thus, hospital noise pollution is a serious environmental problem at public and hospital compounds within the working area. To abate noise problem, a proper use of vegetation and noise barrier are highly recommended.

The Hospital wise results are shown below in tabulated format.

### 4.1 Ganorkar Hospital

**Table 4.1 Noise level monitoring results of Ganorkar Hospital**

| Mean and standard deviation, minimum and maximum values (dBA) of noise levels on wards and other areas in Ganorkar Hospital | | | | |
|---|---|---|---|---|
| | | | | |
| Places | LAeq | SD | Min | Max |
| Reception | 59.8 | 3.2 | 58.5 | 61.1 |
| General Ward | 54.4 | 4.1 | 52.3 | 156.5 |
| Private | 55.55 | 1.5 | 55 | 56.1 |
| Semi-Private | 55.75 | 1.3 | 55.2 | 56.3 |
| Intensive Care Unit | 60.6 | 1.1 | 60.1 | 61.1 |
| Operation Theatre | 66.8 | 2.5 | 65.5 | 68.1 |
| Reception 2nd floor | 61.45 | 1.9 | 60.1 | 62.8 |
| All | 59.19 | 2.23 | 58.10 | 60.29 |

The results above show that this Hospital exceeds the limits of noise level in silent zone. Even the minimum value of $L_{Aeq}$ in db(A) exceeds the limits of noise pollution

### 4.2 Six Sigma Hospital

**Table 4.2 Noise level monitoring results of Six Sigma Hospital**

| Mean and standard deviation, minimum and maximum values (dBA) of noise levels onwards and other areas in Six Sigma Hospital | | | | |
|---|---|---|---|---|
| | | | | |
| Places | $L_{Aeq}$ | SD | Min | Max |

| | | | | |
|---|---|---|---|---|
| Parking/ Front Area | 78.4 | 5.1 | 75.5 | 81.3 |
| Reception - Ground Floor | 73.5 | 4.2 | 71.2 | 75.8 |
| Terrace/ Machinaries | 84.9 | 4.3 | 83.5 | 86.2 |
| Operation Theatre | 65.9 | 3.1 | 64.2 | 67.5 |
| Intensive Care Unit | 48.3 | 2.8 | 47.1 | 49.5 |
| Semi-Private | 55.5 | 3 | 54.2 | 56.8 |
| General ward - 1 | 49.4 | 2.5 | 47.8 | 51 |
| General ward - 2 | 50.1 | 2.6 | 47.9 | 52.3 |
| General ward - 3 | 51.2 | 2.5 | 48.2 | 54.1 |
| Dialysis area | 56.7 | 2.1 | 55.2 | 58.1 |
| General Ward | 66.0 | 4.2 | 64.2 | 67.8 |
| X-ray | 56.1 | 1.5 | 55.2 | 56.9 |
| C.T. Scan | 59.0 | 1.2 | 58.2 | 59.8 |
| Maintenance Dept. | 55.2 | 2.5 | 54.2 | 56.1 |
| Maintenance Outside | 54.7 | 2.8 | 53.9 | 55.5 |
| Outer Area Crowd | 77.3 | 3.1 | 76.2 | 78.4 |
| Compressor Area | 80.8 | 1.8 | 79.1 | 82.4 |
| Admin Block | 56.7 | 2.1 | 55.2 | 58.1 |
| Accounts | 55.8 | 2 | 55.4 | 56.2 |
| TPA | 59.4 | 1.2 | 58.3 | 60.5 |
| OPD | 69.0 | 2.1 | 67.9 | 70.1 |
| All | 62.1 | 2.7 | 60.6 | 63.54 |

**Figure 4.2 Noise level monitoring in Six Sigma Hospital**

### 4.2 Shatabdi Hospital

**Table 4.3 Noise level monitoring results of Shatabdi Hospital**

| Mean and standard deviation, minimum and maximum values (dBA) of noise levels on wards and other areas in Shatabdi Hospital | | | | |
|---|---|---|---|---|
| | | | | |
| Places | LAeq | SD | Min | Max |
| Reception | 73.4 | 4.2 | 70.2 | 76.5 |
| Private | 51.8 | | 51 | 52.6 |
| Semi-Private | 55.5 | 3 | 53.5 | 57.5 |
| General ward - 1 | 61.6 | 2.5 | 57.9 | 65.2 |
| Operation Theatre | 52.4 | 3.1 | 51.2 | 53.6 |
| Intensive Care Unit | 49.9 | 2.8 | 47.3 | 52.4 |
| Surgery ward | 50.0 | 2.6 | 47.6 | 52.3 |
| Dialysis area | 52.7 | 2.1 | 50.1 | 55.2 |
| All | 55.9 | 2.9 | 53.6 | 58.16 |


### 4.3 Civil Hospital

**Table 4.8 Noise Pollution Monitoring Results of Civil Hospital**

| Mean and standard deviation, minimum and maximum values (dBA) of noise levels on wards and other areas in Civil Hospital | | | | |
|---|---|---|---|---|
| | | | | |
| Places | LAeq | SD | Min | Max |
| Front Area | 82.05 | 5.2 | 80.5 | 83.6 |
| Parking | 83.9 | 4 | 82.2 | 85.6 |
| Reception | 78.7 | 4.2 | 77.6 | 79.8 |
| Admin Block | 78.0 | 3.8 | 77.2 | 78.7 |
| Operation Theatre | 65.9 | 3.9 | 64.2 | 67.5 |
| Intensive Care Unit | 54.7 | 3.9 | 54.1 | 55.2 |
| Special ward | 59.8 | 4 | 59.5 | 60.1 |
| General Ward | 69.6 | 4.2 | 68.6 | 70.5 |
| Semi-private | 68.7 | 3.8 | 67.5 | 69.8 |
| Labour ward | 70.3 | 4.5 | 65.2 | 75.3 |
| X-ray | 56.1 | 1.5 | 55.2 | 56.9 |
| C.T. Scan | 53.8 | 1.2 | 52.1 | 55.4 |
| Ortho ward | 55.3 | 2.5 | 54.2 | 56.3 |
| Department of Ophthalmology | 54.4 | 2.8 | 53.9 | 54.8 |
| Outer Area Crowd | 80.0 | 3.1 | 79.4 | 80.6 |
| Maintenance dept. | 77.3 | 3.5 | 76.1 | 78.4 |
| OPD | 68.0 | 3.8 | 67.9 | 68.1 |
| All | 66.0 | 3.38 | 64.85 | 67.16 |


**Figure 4.8 Noise Pollution Monitoring at Civil Hospital**

## 5. CONCLUSION

The measured noise levels surpassed the EPA (1986): Noise Pollution (Regulation and Control) Rules, 2000, acceptable limit on hospital buildings. Conversations between patients and nurses, overcrowding of patient‘s relatives, television and children's screaming were identified as primary sources of background noise on wards; other high- intensity noise sources such as bin lids were also detected during peak intervals. Slamming doors, fiery tempers and the constant ringing of phones; these were all too common occurrences. As a result, these findings may prove useful to individuals responsible for planning and creating policies within the healthcare facility. It is recommended that regular noise monitoring is conducted in order to achieve an optimal environment for patients and staff alike

## 6. REFERENCES

[1]. **Andrade Erik de Lima [et al.]** Environmental noise in hospitals: a systematic review [Journal] // Environmental Science and Pollution Research. - Brazil : [s.n.], 2021. - Vol. 28. - pp. 19629-19642
[2]. **Biswas Dilip** Noise Pollution Regulations in India [Report] : Pollution Control Law Series / Central Pollution Control Board ; Ministryc of Environment & Forests, Govt. of Inida. - Delhi : [s.n.], 2001.
[3].**Gallo Figueroa LM and Olivera J M** Noise Pollution Control System in the Hospital Environment [Journal] // Journal of Physics: Conference Series 705 (2016) 012042. - [s.l.] : IOP Publishing, April 2016. - pp. 1-10.
[4].**González David Montes [et al.]** Environmental Noise around Hospital Areas: A Case Study [Journal] // Environments. - [s.l.] : MDPI, April 2019. - 41 : Vol. 6. - pp. 1-19.
[5].**Khademi Gholamreza [et al.]** Noise Pollution in Intensive Care Units and Emergency Wards [Journal] // Iranian Journal of Otorhinolaryngology. - August 2011. - 4 : Vol. 23. - pp. 141-148.
[6].**MARQUES GONÇALO and PITARMA RUI** A Real-Time Noise Monitoring System Based on Internet of Things for Enhanced Acoustic Comfort and Occupational Health [Journal] // IEEE Access. - 29 July 2020. - Vol. 8. - pp. 139741- 139755.
[7]. **Khaiwal Ravindra [et al.]** Assessment of noise pollution in and around a sensitive zone in North India and its non-auditory impacts [Journal] // Science of the Total Environment. - [s.l.] : Elsevier, 2016. - pp. 981-987.
[8].**Moshi Anna A., Philimoni Kulwa M. and Mkoma Stelyus L.** Noise Pollution on Wards in Iringa Regional Hospital, Tanzania [Journal] // World Applied Sciences Journal. - Morogoro, Tanzania : IDOSI Publications, 2010. - 5 : Vol. 11. - pp. 599- 603. - ISSN 1818-4952.

[9]. **Oguntunde Pelumi E. [et al.]** A Study of Noise Pollution Measurements and Possible Effects on Public Health in Ota Metropolis, Nigeria [Journal] // Macedonian Journal of Medical Sciences. - [s.l.] : ID Design Press, April 2019. - 8 : Vol. 7. - pp. 1391-1395. - eISSN: 1857-9655.