# Comparative Study of Noise Pollution in Key Indian Cities: Pattern Analysis of Day and Night-time Levels and prioritisation of Mitigation Options

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*Abstract-*The goal of this study is to examine the data on noise pollution in major Indian cities, such as Delhi, Bengaluru, Kolkata, Hyderabad, Chennai, and Mumbai. Noise pollution is a serious environmental problem that can harm people's health and well-being. In order to find any patterns in the data, the study will compare the levels of noise pollution present in these cities during the day and at night. The results of this study will shed light on the extent of noise pollution in important Indian cities and its effects on the environment and public health. The study will also aid in identifying the cities with the highest levels of noise pollution as well as the regions within those cities that are most affected. Policymakers can create plans to lower the levels of noise pollution in these cities using the study's findings as a guide. The study can also be used by urban designers to create new urban areas that lessen the effect of noise pollution on locals. Overall, this research study will advance knowledge of noise pollution in Indian cities and guide efforts to lessen its negative effects on the environment and human health.

*Index Terms*- Noise pollution, Data analysis, trends, health

## I. INTRODUCTION

Noise pollution pose a serious health risk to human beings. Long exposure to noise pollution can result in health issues such as hearing loss, anxiety, cardiovascular problems and many more. Almost all major cities in India exceed the limits of noise pollutants recommended by Central Pollution Control Board (CPBC).

Common major sources of noise pollution in India are:
•       Traffic
•       Construction Sites
•       Industries
•       Religious and Cultural Events
•       Public Address Systems

In this study we primarily consider noise pollution level in various localities of major Indian cities. The major cities in consideration for this study are Delhi, Mumbai, Kolkata, Chennai, Hyderabad and Bengaluru. These cities have population of more than ten million each.

There is no readily available analysis of noise pollution data in this biggest commercial hubs of India where a huge population of India resides. Due to lack of proper data our study time period is limited to January of 2015 to December 2018.

This study will give a broad level comparison with respect to the noise pollution level of day time and night time among the above mentioned six cities. We also look at monthly variation of the pollutants in these cities which would give a clear understanding of pollution levels in different seasons if there is any.

## II. METHODOLOGY

The difference between qualitative and quantitative research is the type of data they collect and analyze. Qualitative research involves non-numerical data, while quantitative research involves empirical data. Also primary research involves collecting original data, while secondary research involves using existing data that has been collected by other researchers. Since this study involves analyzing data collected by sensors in various location across a city that is already collected and made available through CPBC website (www.cpbc.gov.in), this activity is a quantitative secondary research.

Noise pollution monitoring involves use of noise monitoring stations that measure sound level around them. These stations are usually equipped with sensors that can measure level of sound. Noise level is usually measured in decibels. The unit used throughout this report is decibels.
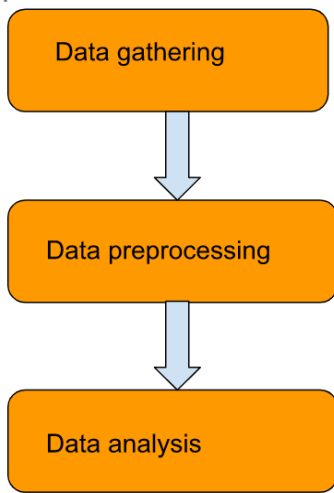


Fig. 1 Work flow diagram

Figure 1 shows the broad work flow that was followed to perform this analysis. First the data was acquired from the source as we intended to perform only secondary research. Secondly the data had records from many other time period that were not in consideration of the study. Those records were dropped along with various other fields that were not relevant to our study.
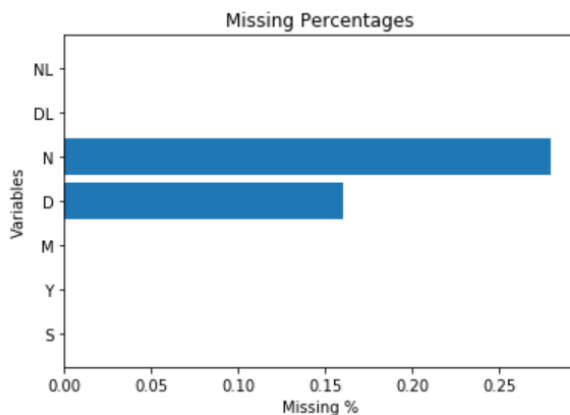


Fig. 2 Percentages of missing values

 Next the data was check against outliers which were non present. Finally among many techniques such as dropping values, using grouped mean/median/mode, forward fill and backward fill, forward fill technique to handle the missing values was used. Figure 2 shows the percentage of missing data.

Finally, clean data was analyzed by grouping them to study the year wise tends and month wise trends. The detailed analysis is discussed in the Discussion section.

## III. RESULT

Figure 3 shows the yearly average noise pollution of Mumbai city from 2011 to 2018. There had been gradual increase in noise pollution level from 2011 till 2017, however there is a decline in 2018. Overall the noise pollution level are way above the limits prescribed by the Central Pollution Control Board of India.
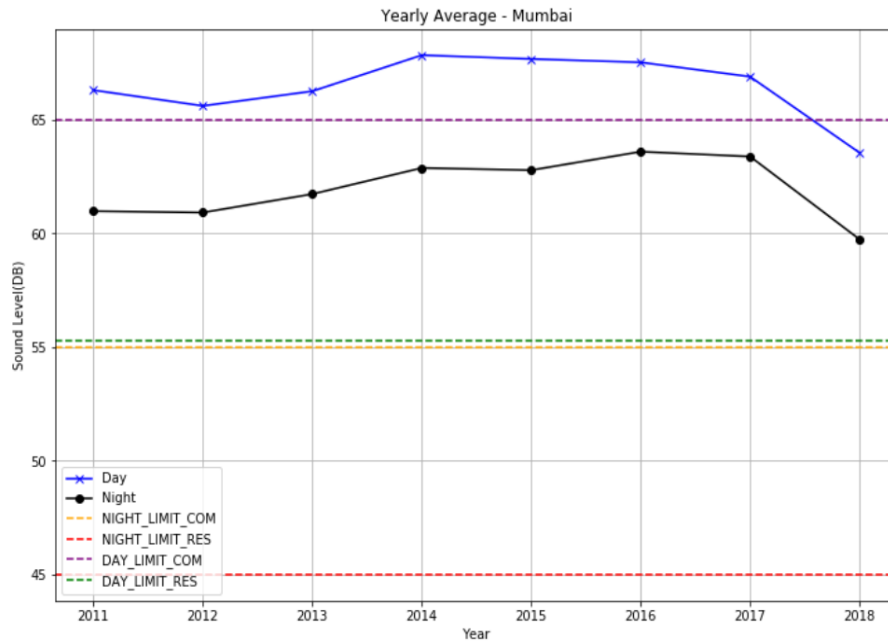
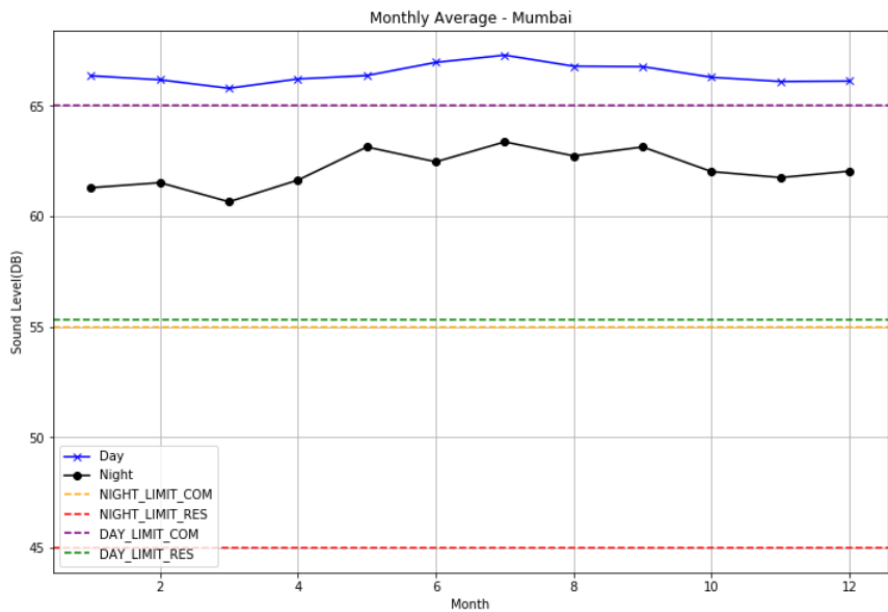

Fig. 3 Yearly average (Mumbai)



Fig. 4 Monthly average (Mumbai)

Figure 4 shows the monthly average noise pollution of Mumbai city from 2011 to 2018. There is not visible seasonal pattern exhibited by the data.
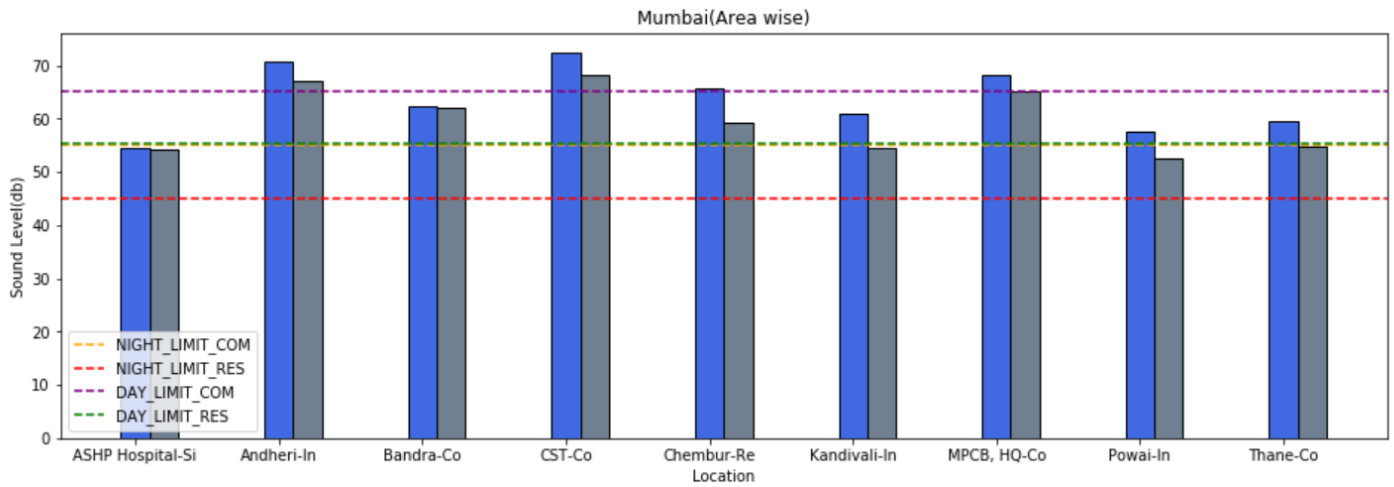
Fig. 5 Area wise average (Mumbai)

When it comes to different localities within Mumbai city, Andheri and CST are worst affected by noise pollution. Powai and ASHP Hospital area slightly better than the rest of the localities as shown in figure 5.

B.    DELHI

Figure 6 shows the yearly average noise level of Delhi. Overall there has been a slight increase in the pollution level in Delhi. However there is a decline in the pollution level from 2016 after a sharp peak in 2015. Figure 7 shows the monthly average noise pollution of Delhi. Similar to Mumbai, Delhi also does not show any seasonal pattern.
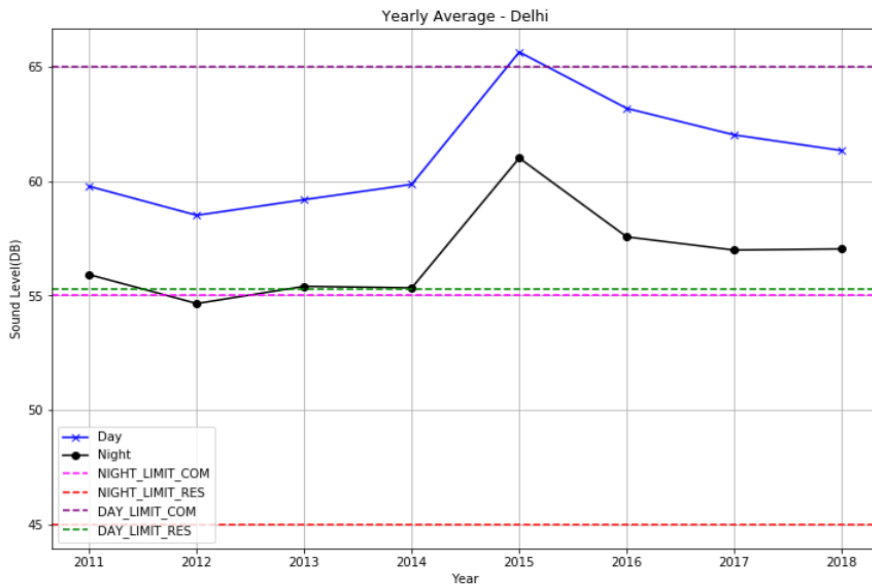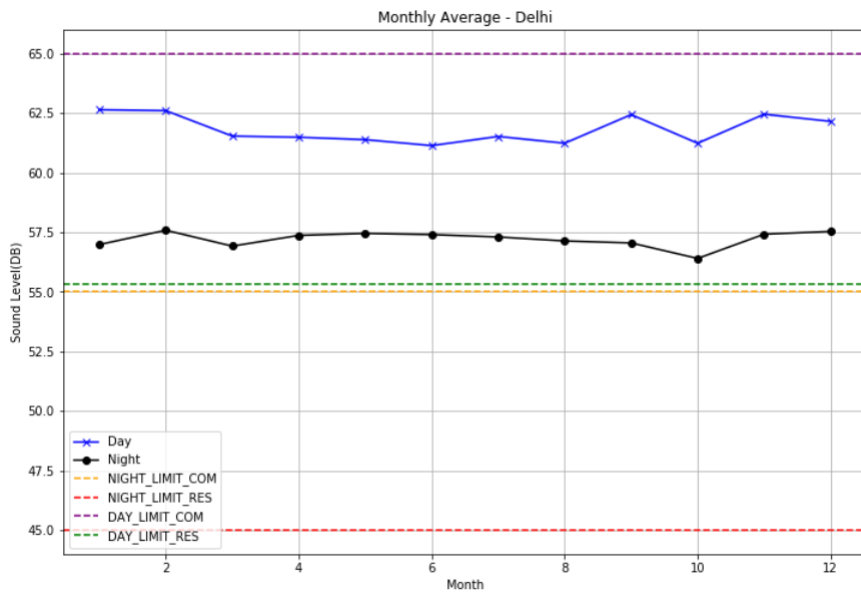


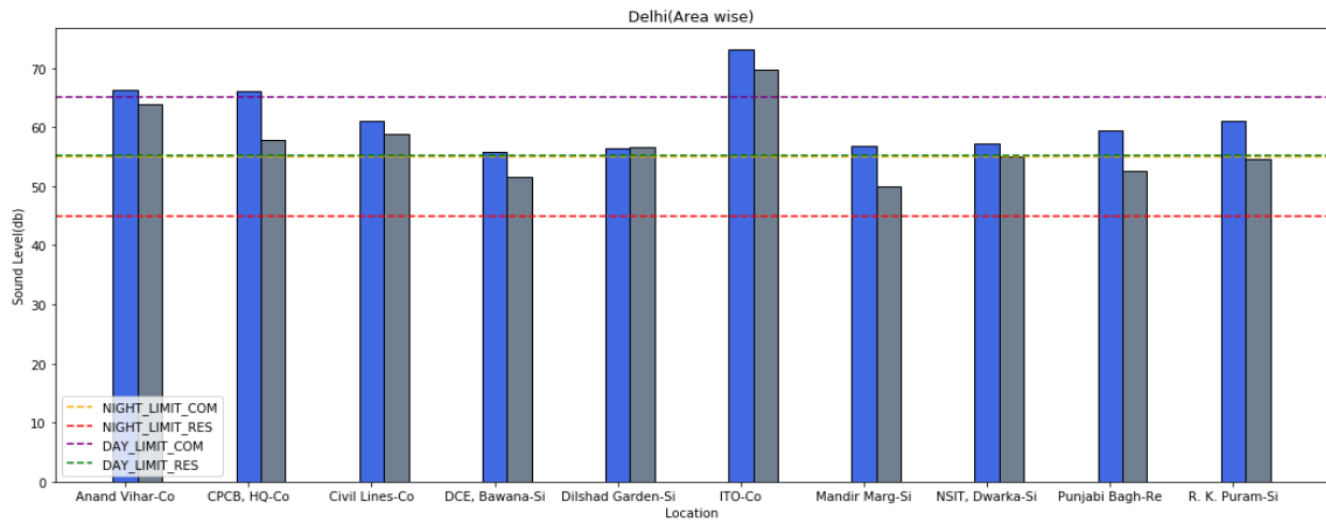Fig. 6 Yearly average (Delhi)

Fig. 7 Monthly average (Delhi)



Fig. 8 Area wise average (Delhi)

Areas such as ITO and Anand Vihar are worst impacted by noise pollution. Mandir Marg and DEC (Bawana) are better when compared to other areas when it comes to different areas within Delhi as shown in figure 8.
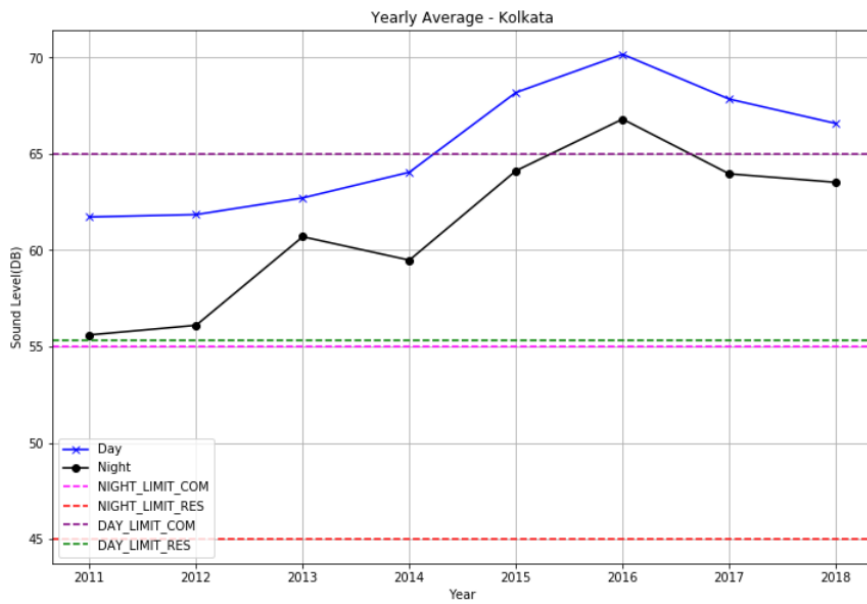
## C. KOLKATA



Fig. 9 Yearly average (Kolkata)

Figure 9 shows the yearly average of Kolkata city from 2011 to 2018. The noise pollution level in Kolkata has been gradually increasing from 2011 till 2016. From 2017 onwards we see a slight decline. The noise pollution level are extremely high and are way above the prescribed limits. Similar to other cities Kolkata has not seasonal pattern as shown in the Figure 10.
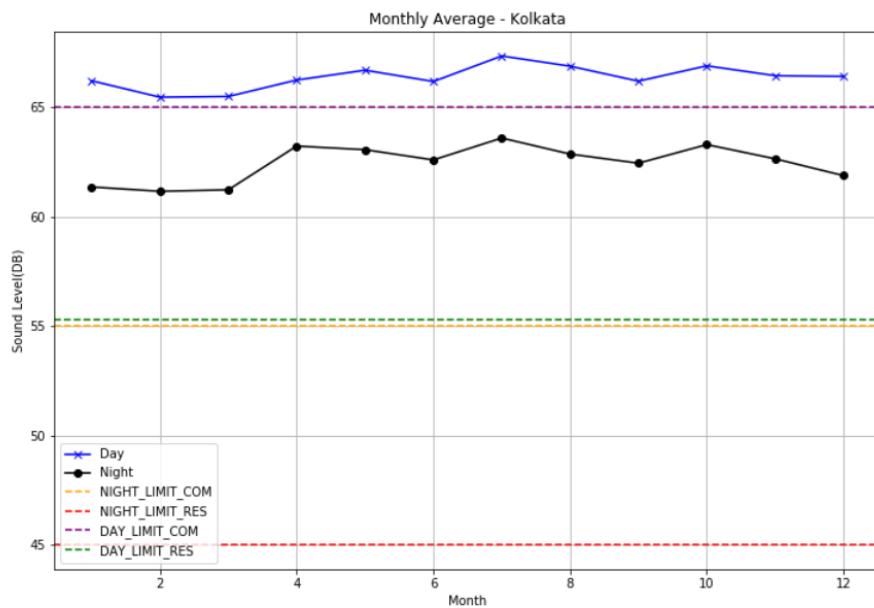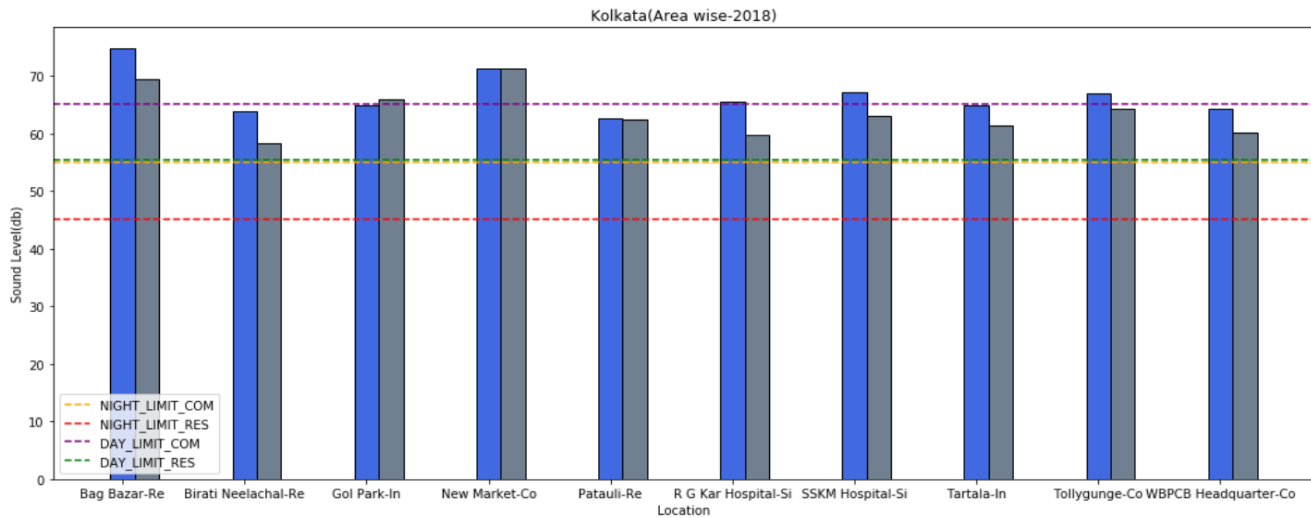


Fig. 10 Monthly average (Kolkata)

Fig. 11 Area wise average (Kolkata)

Areas such as Bag Bazar and new market are worst impacted by noise pollution. Birati Neelachal and Patauli are better when compared to other areas when it comes to different areas within Kolkata as shown in figure 11.

D.    HYDERABAD

Figure 12 shows the yearly average noise level of Hyderabad. The noise pollution level is increasing till 2016 then it plateaus out. Overall the noise pollution level are very high in comparison to the limits set by the CPBC. Hyderabad also does not exhibit any seasonal pattern in the noise pollution data which is shown by Figure 13.
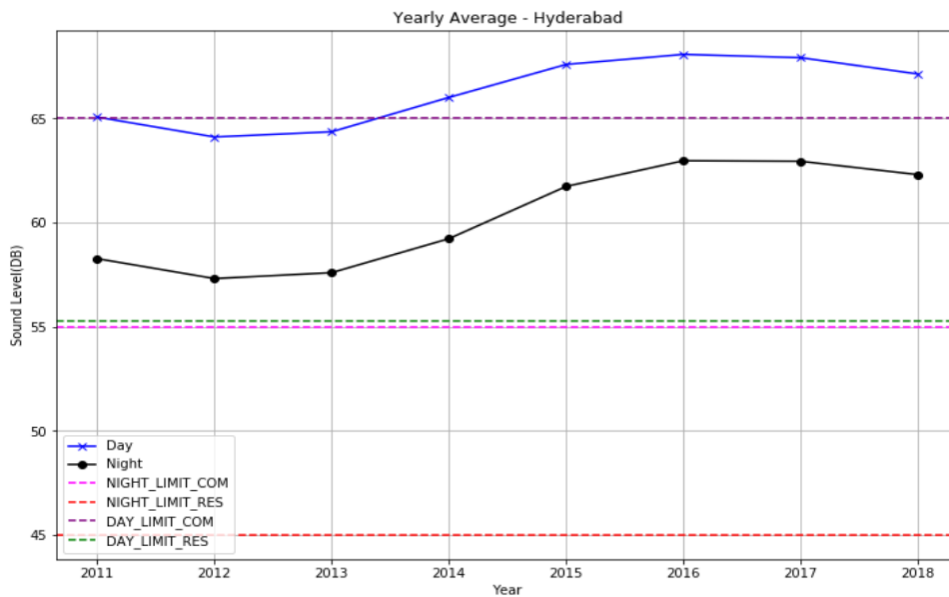


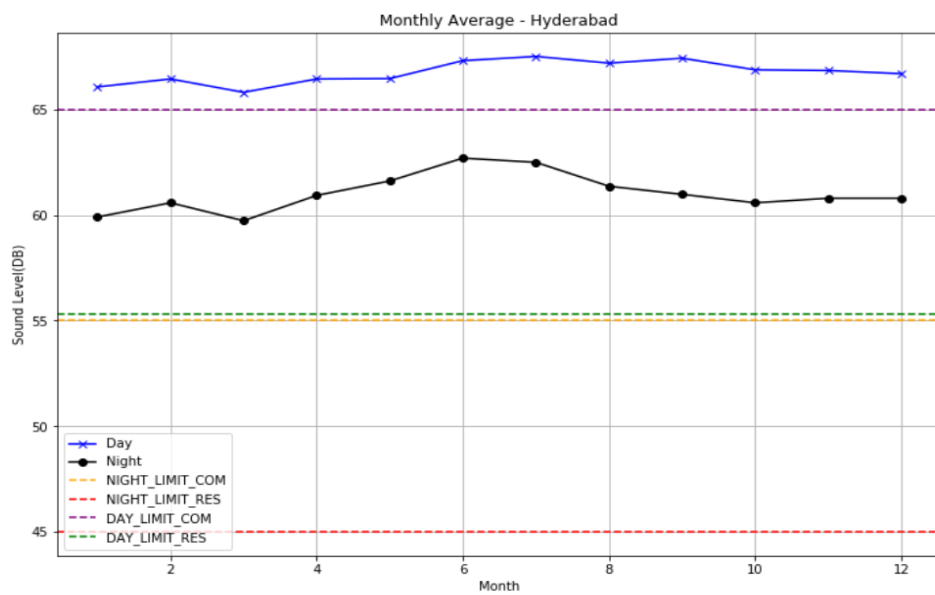Fig. 12 Yearly average (Hyderabad)

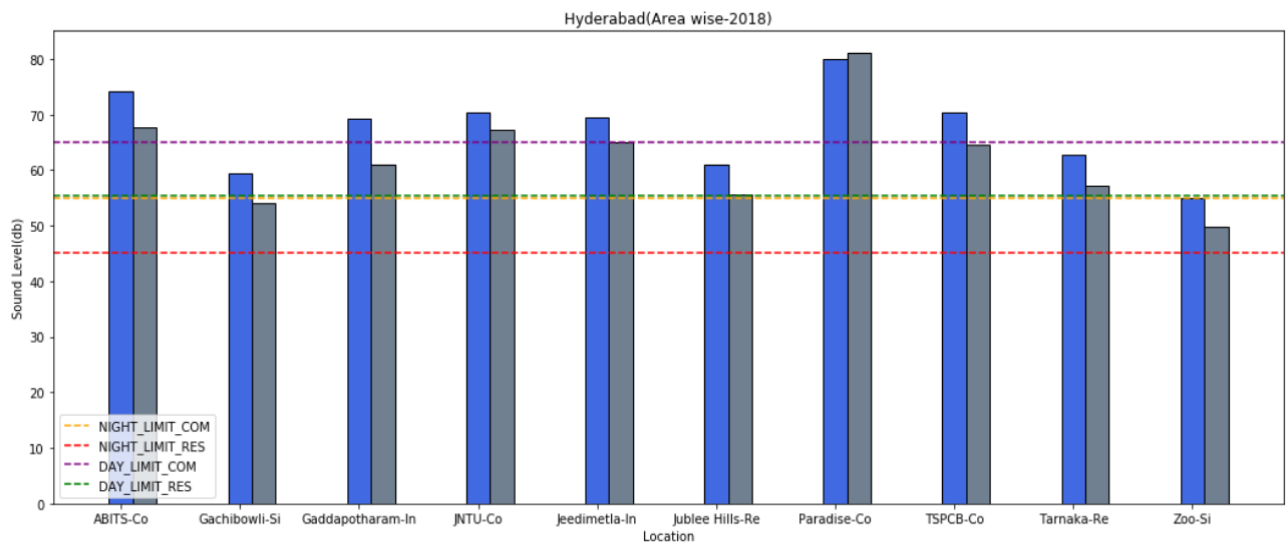Fig. 13 Monthly average (Hyderabad)



Fig. 14 Area wise average (Hyderabad)

Areas such as the Paradise is worst impacted by noise pollution. Gachibowli and Zoo area are better when compared to other localities within Hyderabad as shown in figure 14.

E.      BENGALURU

Figure 15 shows the yearly average noise level of Bengaluru. The noise pollution level is continuously increasing since. Overall the noise pollution level are very high in comparison to the limits set by the CPBC. Bengaluru also does not exhibit any seasonal pattern in the noise pollution data which is shown by Figure 16.
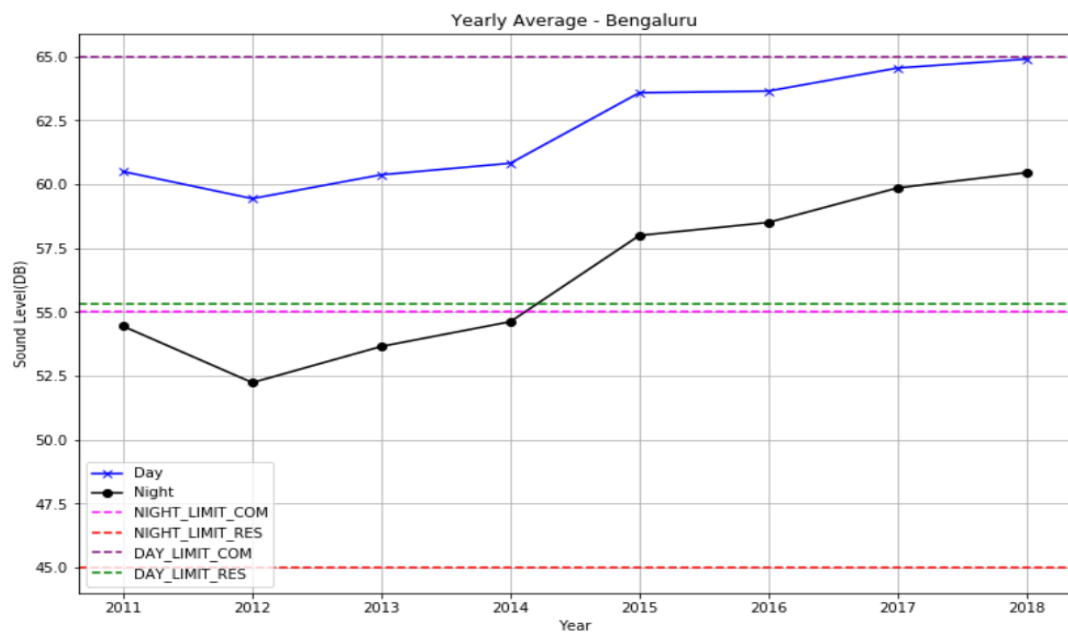
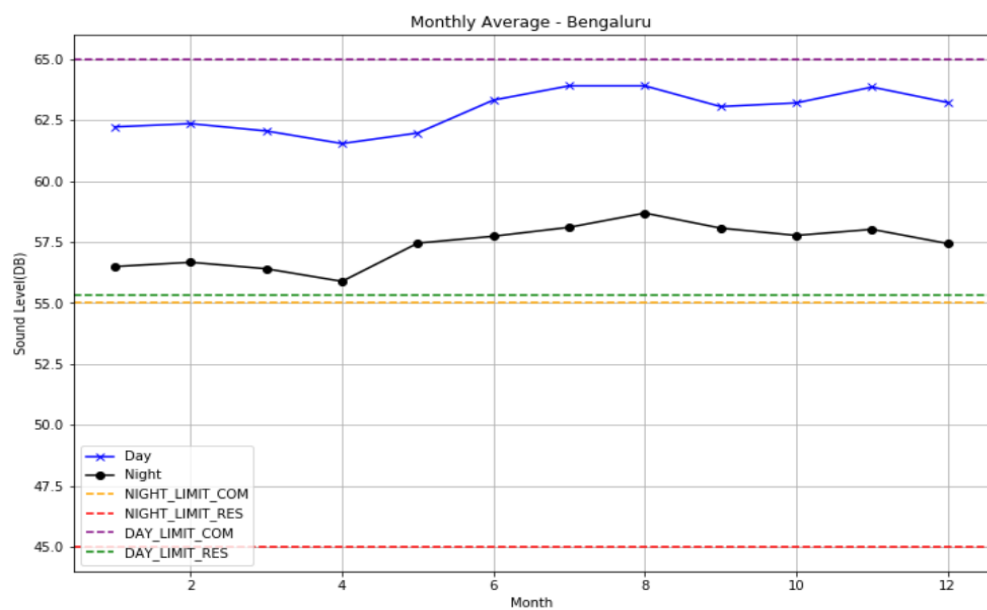Fig. 15 Yearly average (Hyderabad)

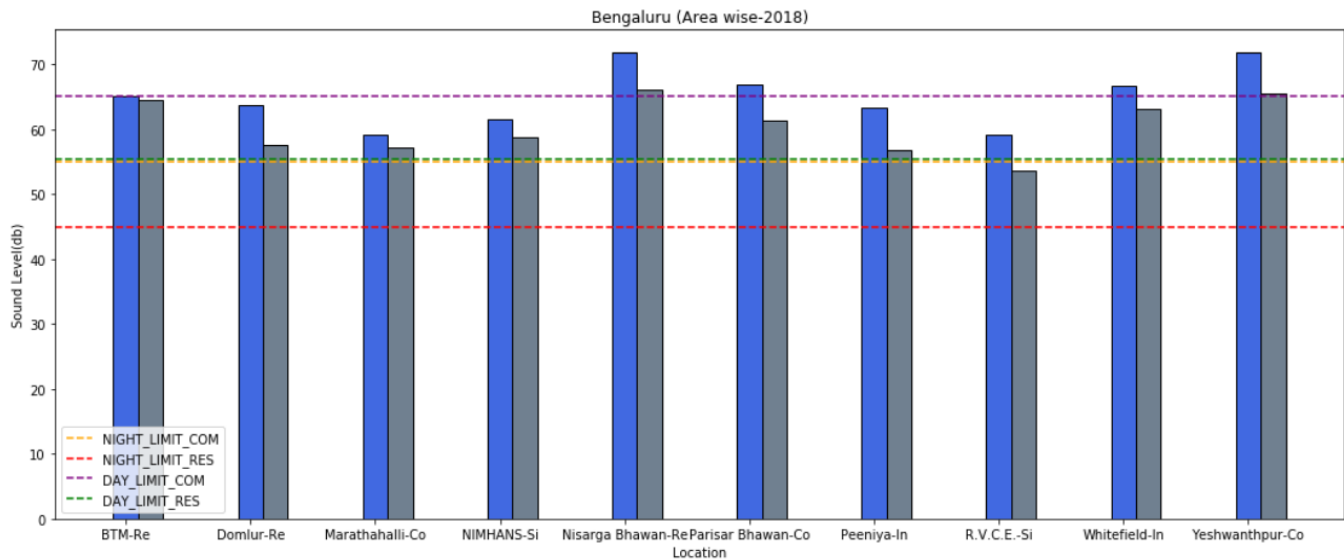

Fig. 16 Monthly average (Bengaluru)

Fig. 17 Area wise average (Bengaluru)

Areas such as the Nisarga Bhawan and Yeshwanthpur are worst impacted by noise pollution. Marathachalli and RVCE area are better when compared to other localities within Bengaluru as shown in figure 17.

F.    CHENNAI

Figure 18 shows the yearly average noise level of Chennai. The noise pollution level is continuously increasing since until 2016. From 2016 onwards there is a slight decline in the pollution level. Overall the noise pollution level are very high in comparison to the limits set by the CPBC. Chennai also does not exhibit any seasonal pattern in the noise pollution data which is shown by Figure 18.
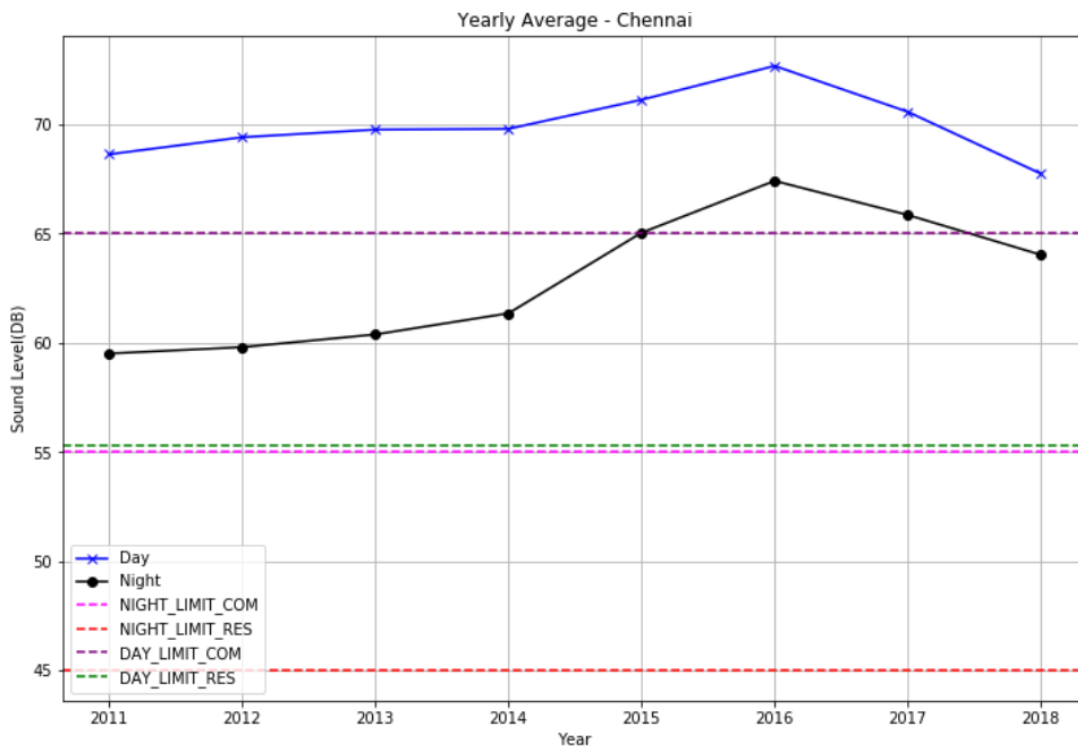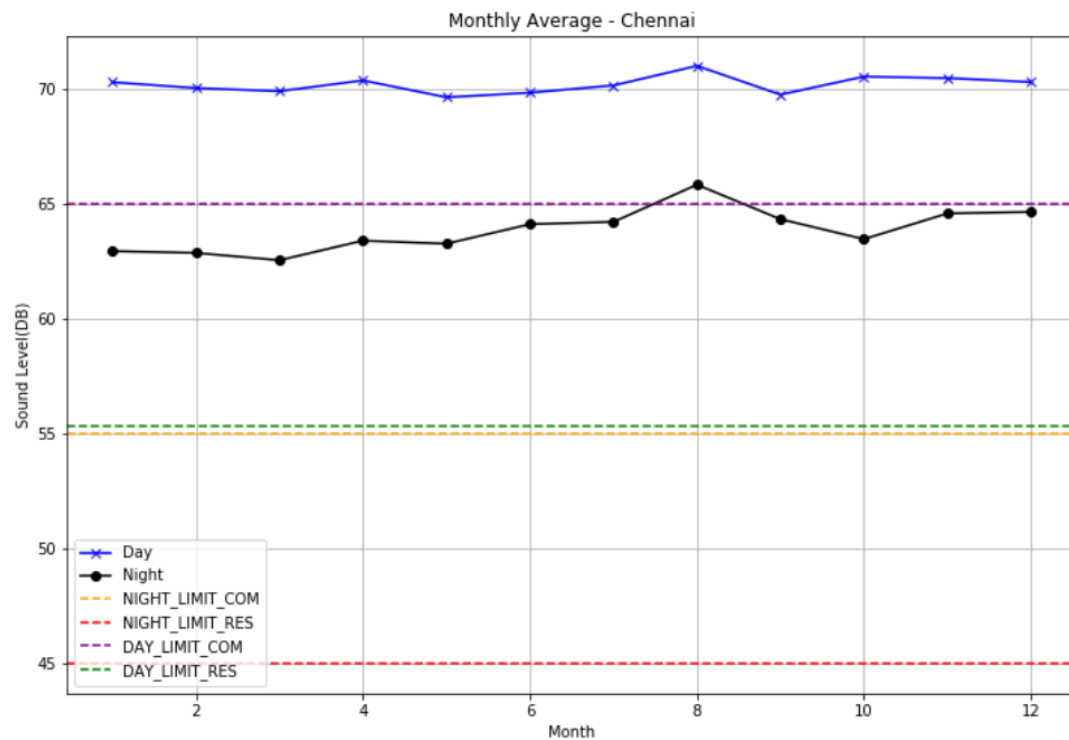


Fig. 18 Yearly average (Chennai)
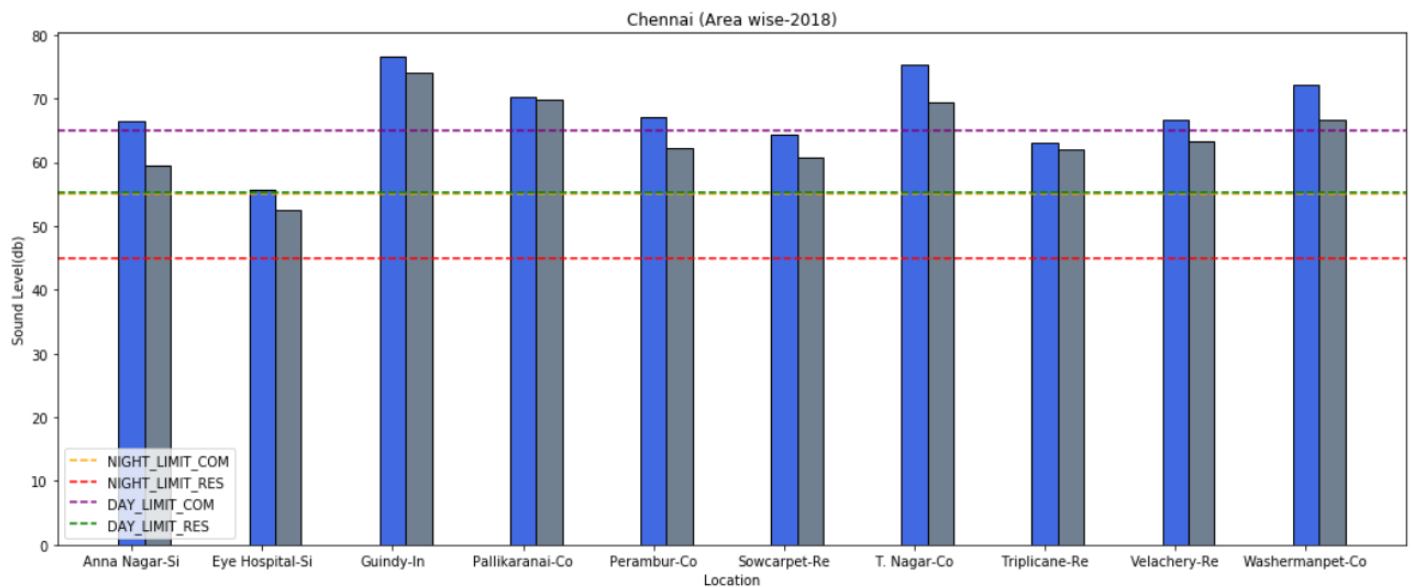
Fig. 19 Monthly average (Chennai)



Fig. 20 Monthly average (Chennai)

Areas such as the T-Nagar and Gundi are worst impacted by noise pollution. Sowcarpet and Eye-Hospital area are better when compared to other localities within Chennai as shown in figure 20.

G.    COMPARISION OF ALL THE CITIES

Figure 21 shows noise pollution comparison of all the six cities for day noise levels. Bengaluru and Delhi are much better situation when compared to other cities. Chennai is the worst affected by noise pollution. The night pollution also depicts exactly same situation as the day levels. The night level comparison is shown by figure 22.
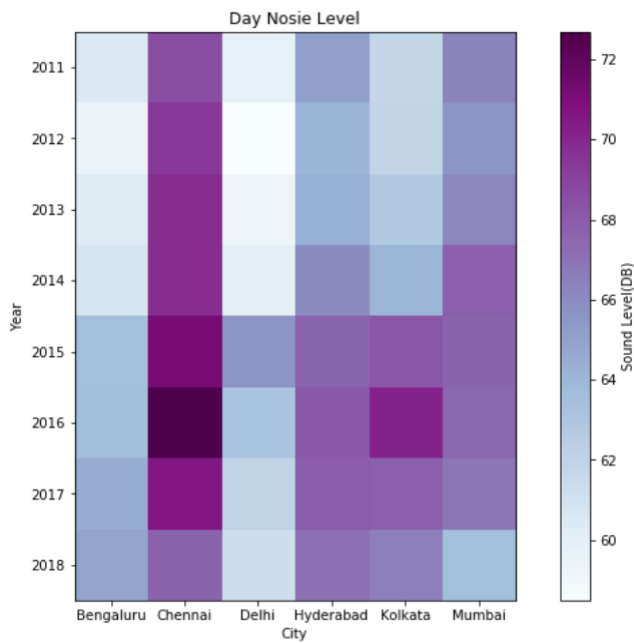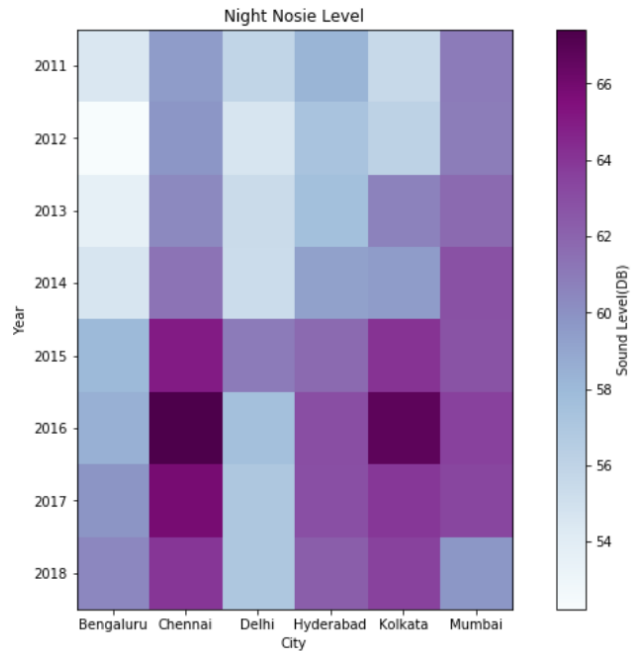
Fig. 22   Day level comparison (all Cities)



Fig 23 Night level comparison (all cities)

IV.   MITIGATION STRATIGIES

The following mitigation strategies are recommended to reduce the rising levels of noise pollution:

- Establish and uphold tight noise regulations with established acceptable levels.
- Launch efforts to raise public awareness of noise pollution and appropriate noise behavior.
- Incorporate zoning laws and urban planning practices that take noise mitigation into account.
- Use traffic management techniques include encouraging the use of public transit, building noise barriers, and putting in place traffic calming measures.
- Increase the amount of green area and use sound-absorbing infrastructure.
- Encourage the use of equipment and technology that is quieter across a range of industries.
- Control construction site activity and put noise-cancelling measures in place.
- Ensure that suitable noise control measures are in place in public areas.
- Promote noise reduction technology research and development.
- Encourage stakeholder participation and cooperation in noise abatement activities.

## V.  CONCLUSION

This research article concludes by emphasising that noise pollution levels in major Indian cities exceed the regulatory bodies' stated limitations. The lack of a seasonal trend in the data indicates that the current restrictions on the use of firecrackers and other loud celebration-related activities have not been successful in reducing noise pollution. All stakeholders must participate in concerted efforts from all aspects to address this prevalent issue. To reduce noise pollution and make Indian cities healthier and more livable, it is essential to implement and enforce stricter noise regulations, increase public awareness, incorporate noise mitigation strategies into urban planning, promote quieter technologies, and involve stakeholders in the decision-making process.

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