# DETERMINATION OF NOISE POLLUTION IN VADAPALANI JUNCTION USING KRIGING TOOL

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**ABSTRACT**

*Noise from vehicles contributes to the high pollution levels in several spots of Indian cities. The development of a city leads to the rapid growth of the number of vehicles which is directly leads to increased traffic congestion and traffic noise. In this study a GIS based noise assessment was carried out at Chennai city in Vadapalani, a Commercial zone. A digital sound level meter is used for assessment of noise level. Noise mapping was done using Geographic information system (GIS) technique. This approach helps to assess the noise levels to which people are exposed and monitor the impact of noise. The spatial analysis and geo statistical methods of GIS can play an important role to control noise pollution. GIS provide framework to integrate noise calculation models with spatial data that can be used for building noise maps. The variation in the noise levels and traffic volume data in the peak hours are studied and presented as noise map for the selected location. This study also includes the effects and remedies which can be provided for minimizing the noise pollution.*

**Keyword:** - *Noise Mapping, Noise Level, Traffic Volume and GIS*

## 1. INTRODUCTION

Noise pollution is an excessive, displeasing human, animal or machine created environmental noise that disrupts the activity or balance of human or animal life. It also affects our general health and behavior. Traffic noise is considered as the major source of noise pollution. Noise can originate from many places. The few good Sources of noise are Household sources, Social events, Commercial activities, Industrial activities and Transportation. The characteristics of noise pollution depend upon Population density of the city, Traffic volume, Speed and percentage of heavy vehicles, Infrastructure, climatic and topographical aspects.

Sound can propagate as a longitudinal waves through compressible media such as air, water and solids and also as a transverse waves in solids. The sound source creates vibrations in the surrounding medium. As the source continues to vibrate the medium, the vibrations propagate away from the source at the speed of sound, thus forming the sound wave. At a fixed distance from the source, the pressure, velocity, and displacement of the medium vary in time. At an instant in time, the pressure, velocity, and displacement vary in space. Note that the particles of the medium do not travel with the sound wave. This is intuitively obvious for a solid, and the same is true for liquids and gases (that is, the vibrations of particles in the gas or liquid transport the vibrations, while the average position of the particles over time does not change). During Propagation, waves can be reflected, refracted, or attenuated by the medium. The behaviors of sound propagation are generally affected by three things: A relationship between density and pressure in the medium. The propagation is also affected by the motion of the medium itself. The viscosity of the medium also affects the motion of sound waves.

The permitted noise levels recommended by BIS at different Land use area as follows given in the Table.1.

Table -1: Permissible Noise Levels

| Type of area | Day Time | Night Time |
|---|---|---|
| Industrial area | 75 | 70 |
| Commercial area | 65 | 55 |
| Residential area | 55 | 45 |
| Silence zone | 50 | 40 |

### 1.1. Noise pollution

Environmental pollution such as air, water, hazardous waste and noise pollution has always been a global concern affecting both the public's health and the planet's fragile ecosystems. The concentration of environmental pollution is significantly increasing and causing serious threat to the quality of the environment. One of the serious issues of environmental pollution is noise. Noise pollution in large urban areas is regarded as a growing problem of communities. Road traffic noise pollution is one of the major environmental problems encountered in our daily life. The exposure to noise from roads, affects more people than noise from any other source. The noise produced by these vehicles is particularly disturbing due to wide variations in frequency and volume. Noise mapping is an optimization technique in its various forms can be derived for different periods of the day or night and by using different noise indicators, noise dose-effect relationships, calculation heights, and calculation techniques.

The main uses of noise maps is to identify and quantify the scale of noise problems at local, regional, national level and provide information for Town Planning and Traffic Management. Urban noise is directly associated to human activities, in transport and industry development. New mapping approaches supported by a GIS can be combined with spatial data analysis and mathematical modeling that further improves the quality of noise maps. Noise maps provide spatial presentation of acoustic situation. Noise maps build in GIS can be used for analysis and management process. Noise effect can be determined in GIS by combining noise levels with the location of people living in the area and their sensibility to noise.

## 2. MATERIALS AND METHODS

### 2.1 Objective

The objectives of this study are as follows

1. To generate the noise maps observation points which represents sound level meter using Arc GIS.
2. To calculate noise levels at each observation point.
3. To determine and compare the noise levels of each interpolation techniques used for Noise mapping.
4. To determine existing vulnerable zones in the study area.

**2.2 Data Collection**

The key first stage in any spatial data project is to gain an understanding of the area under study. The effective way of collecting noise intensity data from the study area is by separating the study area into regular grids of known interval. These grids of known interval are then used to identify the points of observation. The grids are formed using Fishnet Tool in Arc GIS, which are layed over study area Imagery collected. The observation points on the study area are placed with an interval of about 10-30 meters. At each intersection points of grid within the study area noise levels are recorded. This is done in order to measure the accurate noise levels on all the parts and corners of the study area. This gives accurate results from the observation. In order for the noise levels on the edge of the study area to be calculated accurately, it is important to consider the noise sources, and propagation screening objects, from an area beyond and outside the actual area to be mapped. Generally the study area is affected by greater intensity of noise. The sources of this noise are from traffic, commercial buildings, events and activities, etc. The major source of noise that affects the marked observation points is the traffic noise.

**2.3. Field Study & Data Acquisition**

With the sound level meter and the reference map of the study area, the noise levels on each observation points are measured. The observation points are identified by the method of object identification from the reference map. Field measurements have been taken by using the sound level meter for 5 minutes duration on each observation point with max response on. The Sound level meter is held at a height of 1.5m above the ground level. The study area is studied for various traffic flows such as heavy flow and lean flow. It is observed that heavy traffic flow is found on morning and evening peak hours. The lean traffic flow is found during noon time. Then the measurements are carried out during the working days for heavy & lean traffic flow duration on each and every observation points. The peak traffic flow durations are 7am to 11am and 4 pm to 8 pm. The lean traffic flow duration is 1pm to 3pm. Data were measured not continuously in a week but were measured for different days in a different week to gather total overview of noise level data of a whole week. The measured data for each point for different durations are then recorded for analysis.

Noise can be analyzed in various methods and the result can be represented in many forms. Usually noise is analyzed and the results are represented in graphs, charts, etc. But these results give an idea about noise levels only for a particular place and for a particular time. The noise levels for whole area can also be represented using graphs and charts. But these do not gives a clear statement about the prevailing condition. The effective method of representing the noise levels of the area is the method of mapping commonly known as noise mapping. This method of mapping can be easily done using the various GIS platforms available. The results yield from these platforms gives an accurate result and clear idea about prevailing condition. The noise levels of different area for different time durations can only be analyzed easily using this GIS platform

## 3. STUDY AREA - VADAPALANI

Vadapalani is a neighborhood in the City of Chennai in Tamil Nadu, India. It is known for its film studios and the Vadapalani Andavar Temple, which is an important pilgrimage centre. Situated in the western part of Chennai, Vadapalani is an important bus terminus on Arcot Road. Vadapalani is one of the busiest areas in Chennai. Vadapalani is situated at the heart of Chennai, so the area is highly populated. Vadapalani is located at 13.051 degree North and 80.213 degree East and 18m above sea level. HCL Technologies and MCCI Interconnect Solutions are some of the software companies located in Vadapalani. The huge Tata Consultancy Services Office has now been acquired and used by SRM University. Ecphasis InfoTech, and specialized company for web development also located in vadapalani. The Vijaya-Vauhini Studios, Vikram Studios are in Vadapalani, whereas the Prasad Colour Lab and Prasad Studios, Efx Studios, and AVM Studio are in Saligramam. . Reaching vadapalani by local bus includes Vadapalani Jn. Bus Station , Vadapalani P.S Bus Station , Jn. Of P.T.R Rd/Kamaraj Rd Bus Station , Vadapalani B.S Bus Station , And 1st Ave Bus Station are the nearby by Local Bus Stops to Vadapalani . Vadapalini Junction is an important junction in the Inner ring road; it caters the traffic to all the direction of the City. The commercial establishments along the road and the connectivity had increase the traffic of the area. The heavy

traffic flow at the vadapalani junction, especially from Arcot road and koyambedu road, often results in a pile-up. Since the Vadapalani Junction is an important junction, we would study the noise Pollution created at the junction.


***Fig. 1 Study Area- Vadapalani Junction***

### 3.1 USING KRIGING TOOL

The interpolation methods consists of geostatistical methods, such as Kriging, which are based on statistical models that include autocorrelation—that is, the statistical relationships among the measured points. Because of this, not only do geostatistical techniques have the capability of producing a prediction surface, they also provide some measure of the certainty or accuracy of the predictions. Kriging is an advanced geostatistical procedure that generates an estimated surface from a scattered set of points with z-values.

Unlike other interpolation methods supported by ArcGIS Spatial Analyst, the Kriging tool effectively involves an interactive investigation of the spatial behaviour of the phenomenon represented by the z-values before you select the best estimation method for generating the output surface. Kriging assumes that the distance or direction between sample points reflects a spatial correlation that can be used to explain variation in the surface. The Kriging tool fits a mathematical function to a specified number of points, or all points within a specified radius, to determine the output value for each location. Kriging is a multistep process; it includes exploratory statistical analysis of the data, variogram modelling, creating the surface, and (optionally) exploring a variance surface. Kriging is most appropriate when you know there is a spatially correlated distance or directional bias in the data. It is often used in soil science and geology. The outputs obtained using this tool for different time durations are as follows,

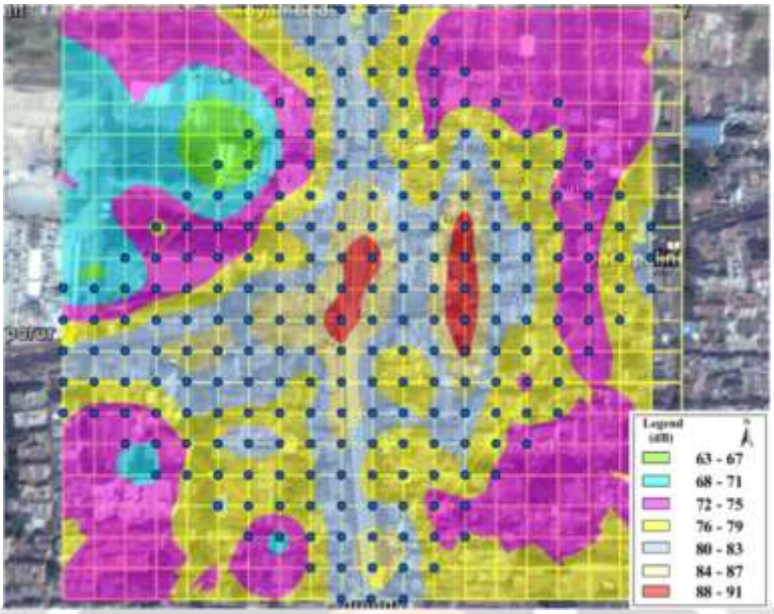


*Fig. 2 Noise Mapping of Vadapalani Junction (7Am – 11Am)*

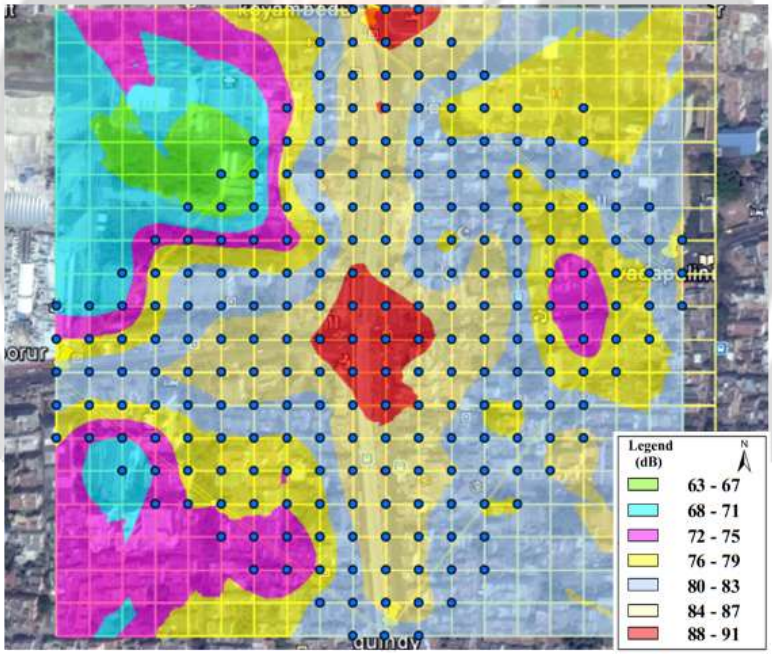


*Fig. 3 Noise Mapping of Vadapalani Junction (1 Pm – 3 Pm)*

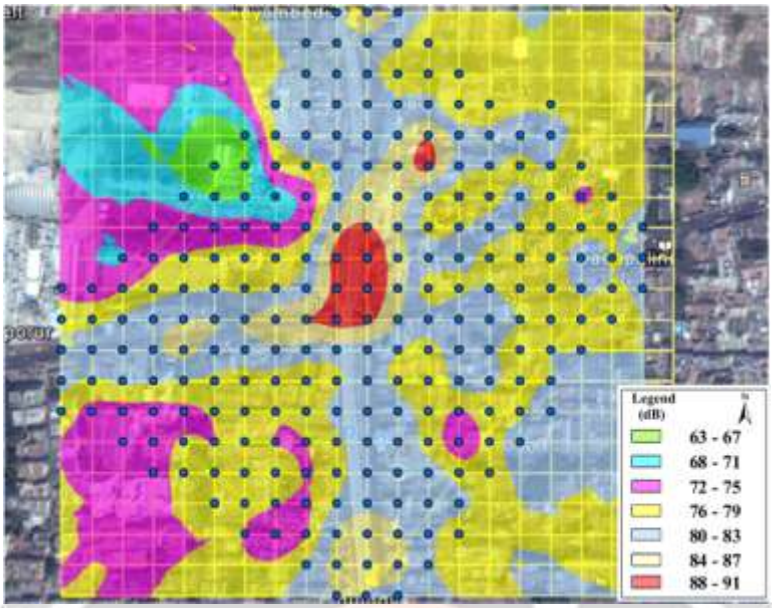


***Fig. 4 Noise Mapping of Ambattur Industrial Estate Junction (4 Pm – 8 Pm)***

## 4. CONCLUSION

The results can be considered as not being acquainted with the environmental noise. However, it was demonstrated that this phenomena had some effects on the personal characteristics and nervousness of the individuals as social consequences; therefore, importance of noise controlling management should be taken into considerations.

Vadapalani is situated at the heart of Chennai, so the area is highly populated and surrounded by commercial buildings. The permissible sound level in commercial area must be 55 to 65 dB. But the noise levels are observed level in commercial area must be 55 to 65 dB. But the noise levels are observed.

In most of the areas the noise level is exorbitant with more than 80dB average prevailing across the city during the peak hour traffic. This is mainly attributed towards congested traffic area and unplanned road network. The high noise levels are persisting even though there is reduced traffic due to one way restriction and construction of silence zone in the main area of the city.

Many schools and hospitals situated in the heart of the city are also affected severely by the noise pollution. The impact investigation based on this 80

GIS noise mapping shows that road vehicles create a high traffic noise impact in Chennai. Through the results obtained in the study it‘s very evident that the Chennai city is suffering from severe noise pollution due to the vehicular traffic and it seems the authorities are less concerned about increase in noise pollution levels.

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