

Journal of Environmental Science, Computer Science and Engineering & Technology



An International Peer Review E-3 Journal of Sciences and Technology

Available online at www.jecet.org

Environmental Science

Research Article

Analysis of Urban Transport Noise Level – A Case Study of Chidambaram Town, Tamilnadu

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Received: 16 September 2013; **Revised:** 14 October 2013; **Accepted:** 25 October 2013

Abstract: Noise pollution in India is assuming greater significance in urban environment due to its varying frequency and intensity. Presently the ambient noise level in Chidambaram Town of Cuddalore District, is an urban area in the state of Tamilnadu, has increased significantly due to increased vehicular density. The present study was made to assess prevailing noise levels and its implications on human lives through field studies, collection of relevant data and by carrying out a questionnaire survey among various stakeholders. The noise levels were measured in fifteen nodal locations / traffic junctions, located in commercial as well as in residential areas. In addition the nighttime noise level and the noise prevailing in the newly developed bypass road were also measured. Measurement of noise levels was carried out on 24 x 7 basis, continuously for a period of seven consecutive sunny days in the month of April 2012. The results of this study reveal that the increase in population, unchecked urbanization coupled with rapid increase in vehicular density and vehicular traffic is the main attributes responsible for noise pollution in the study area. The major effects of noise in the study area include annoyance, communication problem, speech interference, sleep interference, irritation etc. The analysis of results of questionnaire survey reveals the cause-effect relationship among various attributes. Based on the results, suitable recommendations for mitigation of noise in urban environment are given in this paper.

Key words: Urban transport, noise level, vehicular density, vehicular traffic

INTRODUCTION

For many years the daily lives of people, particularly in urban communities Noise has invaded into the day-to-day life. Road traffic noise, which had been becoming steadily more noticeable, was accepted without any complaint until recently. However, it has drawn attention and has stimulated a more critical public attitude towards noise in general. Road traffic noise now produces serious community disturbance. The actual numbers of vehicles involved the upward trend in speed of vehicles; its increased carrying capacity and weight or both together are responsible for higher noise levels. Noise pollution has been stated as a serious health hazard^{1,2}. The influence of noise on man may be physical or psychological. Nelson³ reported that long-term exposure to high occupational noise can result in permanent hearing loss. Many surveys addressing the problem of noise pollution in many cities throughout the world have been conducted which have shown the scale of discomfort that noise can cause on people⁴⁻⁶. The effects of noise are dangerous and worrisome in long term perspective. Depending on its duration and volume, the effects of noise on human health and comfort includes annoyance, speech interference, deterioration in quality of sleep, stress related heart diseases as per Morrell et.al⁷ and psychological effects like irritability, reduction in productivity and misunderstanding what is heard⁸⁻¹¹.

Protection or reducing the negative effects from the out door noise needs to be addressed by proper planning, zoning of towns, using noise barriers, improving the noise control technology, legal measures, better law implementation, proper awareness and education. With increase in urbanization and the number of vehicles plying on the roads especially after opening up of economy in India during 1990's, the transport induced noise levels has reached a disturbing proposition. Most of the people in India are yet to recognize the impacts caused by noise in their day-to-day life. After the evolution of Environmental Impact assessment in India during 1994, the need for controlling the noise was felt and thus the regulation in the form of ambient air quality in respect of noise was evolved in the form of Noise Pollution (Regulation and Control) Rules B under the Environmental (Protection) Act 1986, giving some guidelines with reference to industrial, commercial and silent zones¹². Noise control has to be done at source, or on the path of transmission or at the receivers end. On an average noise barriers can reduce the noise levels up to 6 dB(A) depending on the material, design and height¹³. To have the best result in reduction of transport noise, rows of trees have to be planted perpendicular to the direction of sound field¹⁴. Long and fleshy leaves with wide palm are more effective at reflection and absorption of sound¹⁵.

The government has adopted a number of policies to mitigate the magnitude of pollution to manageable levels to ensure better environmental conditions but most of them are not implemented effectively due lack of proper institutions, legal systems, political will and competent governance. Improving the urban governance, through increased transparency and accountability is a key to the successful implementation of any urban management policy and plans¹⁶.

This paper reports the study that was carried out to investigate the transport noise levels in important traffic junctions and densely populated areas of Chidambaram Municipal Town, Cuddalore District in the State of Tamilnadu to identify the factors responsible for noise, its implications and also recommends suitable measures for noise mitigation.

MATERIAL AND METHODS

The study was carried out in three phases. In the first phase, all relevant data / particulars like study area map / study area details, population, profile of town, characteristics of vehicles used and its

density were collected from Department of Municipal administration and from the Transport Department, Government of Tamilnadu. Chidambaram is located at latitude 11.4° N and longitude 79.7° E at an elevation of 5.75 m above MSL. **Figure 1** shows the location map of Chidambaram.



Figure 1: Location Map of Chidambaram Town

In the second phase using the Sound Level Meter, make LUTRON (Model SL-4011), noise level measurements were done at fifteen important nodal locations which includes Primary and Secondary streets, street junctions/intersections that are densely populated and where maximum traffic volume and noise problem ought to take place were identified¹⁷. **Figure 2** shows the nodal locations in Chidambaram town where noise levels were observed.

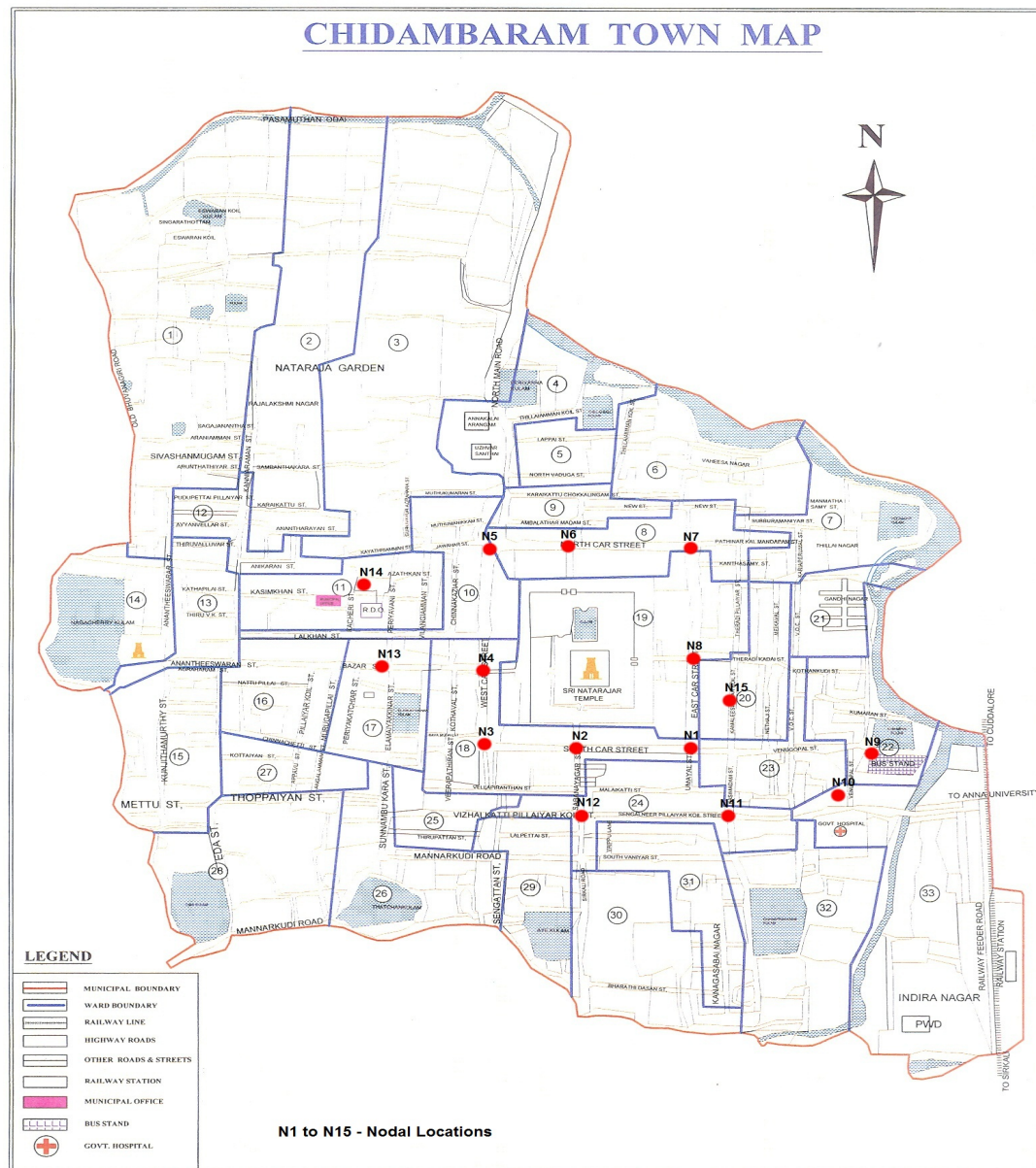


Fig. 2: Nodal locations in Chidambaram Town where noise levels were

The noise levels were observed at these locations during sunny days from 6.00 a.m. to 10.00 p.m. (day time noise) and from 10.00 p.m. to 6.00 a.m. (night time noise) continuously for a period of one week commencing from April 22, 2012 with a time interval of twenty minutes. The prevailing noise levels at Government Hospital, a residential area (named Kanagasabai Nagar), newly developed Chidambaram bypass road and the noise level in Chidambaram town were observed. Noise observations were made at 1.2 m above ground level and at a distance of 2 to 3 m from noise sources as defined by Ramis et.al¹⁸, Piccolo et.al¹⁷, and Jamrah et.al¹⁹. Based on the continuous data obtained for the week the average sound pressure levels (L_p) were determined using the mathematical expression, given by equation (1).

$$L_p = 20 \log \left(\frac{1}{N} \right) \sum_{j=1}^N 10^{\left(\frac{L_j}{20} \right)} \quad (1)$$

where L_p = the average Sound Pressure Level in $dB(A)$

N = Number of observations

L_j = the j th sound pressure level in $dB(A)$ and $j = 1, 2, 3, \dots, N$

In third phase in order to have subjective correlation, a comprehensive questionnaire survey with open ended questions was carried out with all stake holders and in all with 198 heads, of different age groups, sex, geography, education and income levels to assess the sources, effects and possibilities to control the noise. The information gathered during the questionnaire survey includes general characteristics of the respondents, possible source and causes for noise, the time during which the noise occurs, characteristics of noise and present problem with prevailing noise and measures recommended for noise mitigation. The data collected were analysed to understand the cause effect relationships.

Profile of Study Area: Chidambaram is the selection grade municipal town situated in Cuddalore district located at a distance of 245 km south of Chennai. The Chidambaram town spreads over an area of 4.80 sq km with a population of around 62000. It is one of the important temple towns in Tamilnadu state and also a taluk head quarters. The town is well connected by rail and road transport towards South and North. It is located on National Highway (designated as NH 45A) connecting the city of Chennai and the town of Nagapattinam in south. The Chidambaram town is considered as historic since the famous Lord Nataraja temple built during the Chola period is located in the centre of the town. In addition, the town receives more floating population, due to the presence of Annamalai University established in 1929. Based on the survey conducted by Directorate of Town and Country Planning, about 41.09% of town's total land is used for residential purpose, commercial 3.26%, roads 11.77% and other uses 22.36%. **Fig.3** shows the decadal population in Chidambaram town from 1951-2011. The decadal growth in population was found to be high at 17.2%, 19.9% and 14.6% in 1961, 1971 and 1981 respectively, while the decadal growth in population in 1991, 2001 and 2011 were found to be far less at 5.0%, 0.4% and 5.4% respectively.

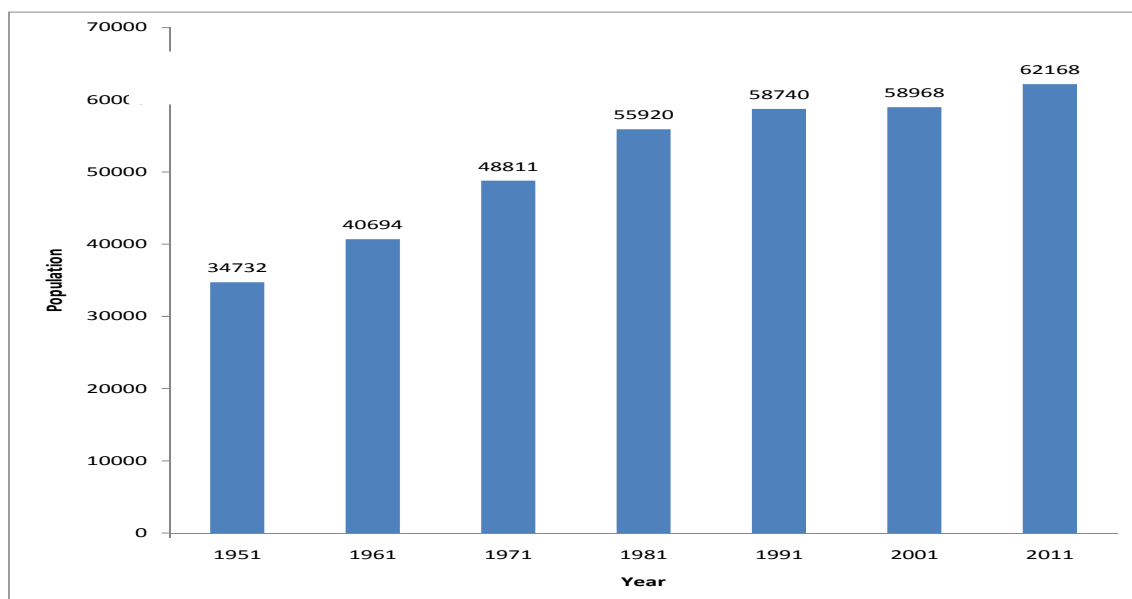


Fig. 3: Population over the decades in Chidambaram Town

Present status of Transport in Chidambaram town: The rapid increase in number of vehicles (vehicle density) almost leads to a situation that, in Chidambaram town all the major and main streets are cramped and congested due to heavy traffic. All The four main streets and the streets which are perpendicular or parallel to the main streets are infested by large scale Air and noise pollution. **Table 1** provides the percentage composition of different vehicles registered during the period 1994 to 2011 at the Chidambaram Road Transport Office. The two wheelers represent four-fifths of the total vehicles registered during the said period, while the four wheelers and heavy vehicles constitute only one-fifth of the total vehicle population.

Table- 1: Nature of vehicle Registered and its percentage distribution

Types of vehicle	No. of vehicles	% of vehicles
2 wheeler	29632	80
4 wheeler	1852	5
Heavy vehicles	5556	15
Lorry	1500	
Tourist bus	484	
Auto	1200	
Mini Trucks	800	
Private bus	72	
Corporation bus	1500	

Causes for road traffic noise in Chidambaram Town

- Increase in population and exponential growth of private vehicles.
- Economic growth induced change in life style.
- Lack of awareness about the consequences of noise.
- Poor law enforcement.

- Increased number of heavy vehicles and use of High intensity horns.
- Increased community reliance on road and reluctance to accept public transport / alternative mode of transport.
- Poor transport planning, and Mushrooming of buildings near to carriage ways.
- Haphazard parking of vehicles on the streets.
- Bus stops / shelter at inappropriate, crowded location.
- Poor land use planning, and lack of buffer for future expansion
- Absence of integrated transport management system.
- Unexpected build up of traffic beyond the design condition due to rapid growth of town
- Poor driving sense, lack of application for ideal driving.
- Over speeding, vibration, inconsistent braking and continuous use of horns.
- Poor road width and narrow lanes.
- Cutting of trees along the roads and absence of any barrier.
- Barking dogs menace and car alarms
- Loads speakers used during social gathering and in Marriage halls
- Absence of zoning in the town, etc.

RESULTS AND DISCUSSION

The road traffic noise was measured in fifteen predetermined locations of Chidambaram town. The average minimum and maximum sound pressure levels observed at various nodal locations were given in **Table 2**. The minimum and maximum sound pressure levels observed in Kanagasabai nagar (Residential zone) varied between 63 to 74 dB(A) and in newly developed Chidambaram By-pass road which connects the Northern part of NH 45A to its South, the minimum and maximum noise levels were found to be 65dB(A) and 97 dB(a) respectively. The noise levels recorded in all the fifteen location of Chidambaram town exceeded the ambient noise standards of 55 dB(A) and 65 dB(A) prescribed for residential and commercial areas respectively.

Since many residential complexes, individual houses, hospitals, banks and commercial establishments are located in four main streets, the minimum and maximum sound pressure levels observed in all the four primary streets (nodal locations 1 to 8) varied from 60 dB(A) and 109 dB(A). The results of the questionnaire survey (**Table 3**) reveal the sources contributing to noise pollution in the study area.

From **Table 3**, it is found that more than fifty percent (52.42%) of respondents living in primary streets identified that vehicular traffic as the most important source for noise followed by neighborhood noise (17.43% of respondents), Public address system used for religious and political events (10.24%), construction noise (8.45%), operating the generators (8.28%) and music system (3.18%). In the secondary streets the conditions are slightly contrasting, the noise from the road transport / automobiles (43.12%) is followed by public address system (20.29%) and construction noise (15.23%). Among the various factors contributing for the increase in road traffic noise (**Table 4**), increase in population (21.09%), increase in vehicular traffic (28%), and lack of awareness about noise (15.64%) and poor traffic management (14%) are the causes for increased noise levels at primary streets. In secondary streets other than these factors parking of vehicles haphazardly (3.84%), increased use of horn (7.12%) is identified as major cause for noise.

The intensity levels of noise are designated and given in **Table 5**. In Primary streets, the majority of respondents (62%) reported that the prevailing noise intensity levels are very high followed by high intensity (27%) and moderate intensity (7.29%). A few respondents reported that noise levels are said

to be pleasant (2.44%) in between 4 a.m. and 6 a.m. In Secondary streets, many respondents reported that the prevailing noise levels are high (40.94%), followed by very high (32%), moderate intensity (17%) and low intensity (4.84%).

Table 6 presents the effects of noise on human beings as perceived by the respondents who were covered by the questionnaire survey. Communication problem and speech interference and annoyance are listed as the major effects of noise on humans by more than 50% of respondents residing in Primary as well as Secondary streets.

Table- 2: Sound pressure levels at various locations in Chidambaram town

Nodal Locations	Primary/ Secondary Streets	Name of the location	Sound Pressure Level dB(A)		Average Sound Pressure Level dB(A)	
			Min	Max	Day Time	Night Time
1.	P	South main street junction– Eastern end.	63	99	84.29	74
2.	P	South main street junction – Middle.	65	95	80.10	75.70
3.	P	South main street junction – Western end.	66	100	82.29	77
4.	P	West main street Junction - Middle.	63	102	80.20	74.70
5.	P	West main street Junction - Northern end.	60	109	80.00	70.83
6.	P	North main street Junction – Middle.	60	99	84.60	75.37
7.	P	North main street junction – Eastern end.	61	100	80.47	77
8.	P	East main street junction – Middle.	61	99	82.83	73.87
9.	P	Chidambaram bus terminal.	63	102	83.14	75.91
10.	S	Gandhi statue Junction – (near railway station)	61	100	81.59	76.95
11.	S	S.P. Koil Street Junction (near Vegetable market)	61	92	76.75	72.16
12.	S	Sabanayagar Street Junction (near Pachaiyappa's school)	58	101	80.12	73.25
13.	S	Kasukadai Street (Basar).	60	100	78.18	73.91
14.	S	Court Complex.	60	99	78.87	70.08
15.	S	Kamaleeswaran Koil Street.	61	99	80.25	73.37

P – Primary Street, S – Secondary Street

Table- 3: Sources contributing to noise in Chidambaram Town

Source	Percent of Respondents from	
	Primary Streets	Secondary Streets
Road transport noise / Automobiles	52.42	43.12
Public address system(Religious / political functions)	10.24	20.29
Generators	8.28	4.23
Neighborhood	17.43	14.68
Construction Noise	8.45	15.23
Music system / TV	3.18	2.45
Railway / Air traffic	Nil	Nil

Source: Based on field survey; Total No of respondents – 198

Table- 4: Factors responsible for increase in noise pollution

Factors	Percent of Respondents from	
	Primary Streets	Secondary Streets
Increase in population	21.09	19.77
Increase in No of vehicles plying on the roads	28	29.21
Increase in noise levels of horns used	6.43	7.12
Presence of Industries	1.48	Nil
Lack of awareness	15.64	16
Poor law implementation	9.93	12.23
Haphazard parking of vehicles in the streets	3.43	3.84
Poor traffic Management	14	11.83

Source: Based on field survey; Total No of respondents – 198

Table- 5: Classifying noise based on its Intensity

Classification	Percent of Respondents from	
	Primary Streets	Secondary Streets
Very High	62	32
High	27	40.94
Moderate	7.29	17
Low	1.27	4.84
Pleasant	2.44	5.22

Source: Based on field survey; Total No. of respondents – 198

Table- 6: Effects of noise on Human beings

Effects	Percent of Respondents from	
	Primary Streets	Secondary Streets
Annoyance	25.18	23.23
Communication problem and Speechinterference	34.25	33.42
Irritation	14.28	15.82
Permanent Threshold Shift	2.18	Nil
Rise in BP / Change in Moods	12.28	10.96
Headache / giddiness	11.83	10.25
Fatigue	nil	1.65
No such effects	nil	4.67

Source: Based on field survey; Total No of respondents – 198

SUMMARY AND CONCLUSION

Chidambaram is an important temple town in Tamilnadu. It has many unique features and it is a pioneering town in making gold plated ornamental jewels. The town has attracted large population from all over the country due to the presence of Annamalai University. Recently the town has attracted people from near and far away places to have their education and employment. This leads to environmental problems. Noise is one of the major problems now and in most of the places of the town the noise levels exceeds 80 dB(A). This is mainly due to the movement of heavy vehicles, followed by noise created by horns and loud speakers used for religious and political gathering.

Disturbing conditions of high noise levels are largely experienced by the people using the facilities such as hospital, school, park and houses along the roads, since highway road is passing through the city, increased traffic density and due to slow moving traffic²⁰.

The field survey reveals the fact that, perception of the people about noise has changed considerably both in Primary and Secondary streets. The intensity level during majority of the period in daytime is very high and continuous exposure to this may leads to hearing impairment. The nighttime noise observed in many places within the town indicates that sleep disturbances is a common phenomena.

The effect of noise pollution on health is both physiological as well as psychological. Many studies have proved that there is direct relation between noise and annoyance. The tolerance limit (threshold limit) varies from person to person. The noise exposures during sleep may increase blood pressure and pulse rate in addition to headache and nausea. These complaints are also reported in field survey.

The above discussions throw sufficient light on the sources, cause effect relationship of noise. The transport noise is of major concern followed by other factors including lack of awareness. The slight difference exists in the noise that prevails in the Primary and Secondary Street, and the respondents identified the noise in the range of very high and high intensity. Hence it becomes imperative to take urgent initiatives to reduce ambient noise levels to protect the societal health.

RECOMMENDATIONS

The following are the possible measures recommended to mitigate noise,

- Land use zoning must be adhered
- Creating awareness and an attitude to care for environment among all the stakeholders
- Better law implementation and accountability.
- Banning the movement of heavy vehicles inside the town.
- Increased policing at all junctions, removing the encroachments.
- Improving the green belt of the town by planting trees.
- Increased use of public transport.
- Integrated, efficient transport management system.
- Ban in use of horns and loudspeakers within the town limits.
- Evolving new noise level standards based on the existing scenario.
- Mandatory provision for buffer zone in front of all emerging buildings.
- Better environmental strategies for sustainable environment.

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