VEHICULAR SOURCE ASSESSMENT CONTRIBUTINGTO NOISE LEVEL AT TRAFFIC JUNCTIONS IN THANE CITY [M.S.] INDIA.

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ABSTRACT

Noise pollution is emerging as one of the major environmental challenges in modern life as it has significant detrimental effect on human health and environment. With increasing number of vehicles in urban areas, improper public transport management, poorly planned urbanization and rapid industrialization, the noise levels have exceeded the tolerance limits. Present study deals with the noise assessment of road traffic during peak hours at three prime junctions of Thane city (Maharashtra State); It was aimed to assess roadside noise levels with respect to vehicular congestion. Study revealed that the noise levels of all the study locations during day and night peak hours ranged between 72 dBA - 81 dBA and 70 dBA - 80 dBA respectively. The noise levels exceeded the permissible limits given by Central Pollution Control Board and three wheelers formed the major portion of the sampled traffic across all locations.

Keywords: Noise, vehicular traffic, Congestion, Junctions, Pollution, Thane.

I.INTRODUCTION

Noise is usually defined as unpleasant, undesired and unwanted sound which disturbs the environment and has a significant impact on the quality of life. With expanding city limits the network of roads connecting these are asare also spreading accordingly and so the number of vehicles on road [2]. Over the past decade, noise has become a major reason for environmental pollution in the metropolitan areas around the world [17]. In comparison to the other pollutants like air or water pollutants, noise has no residual evidence to serve as a continuing reminder of its unpleasantness [5].

Travel, particularly by private vehicles has increased tremendously during the past few years [16]. The noise originating from vehicular traffic is generally dependent upon the vehicle type, characteristics of the vehicle flow and the relative proportion of the vehicles in the flow, vehicular congestion, behavioural patterns of pedestrians and drivers especially in residential areas. Noise level increases with traffic volume in an exponential manner [13]. The growing number of vehicles emits more continued noise and has proportionate health hazards like increased blood pressure, headache, restlessness, etc [2]. Vehicular noise gets amplified by

narrow streets and tall buildings, which produce a canyon in which traffic noise reverberates. Exposure to traffic noise is often higher in the countries without proper planning and poor enforcement of regulations [4].

Noise pollution arising from vehicular movement needs to be controlled to avoid its detrimental effects on the human health. Keeping this on the agenda, Central Pollution Control Board has set up permissible levels for various areas of a community namely commercial, residential, Industrial and silence zones.

Table 1: Standards of noise level for various areas of a community by CPCB

Area code	Category of area/zone	Limits in dB (A)	
		Day time	Night-time
(A)	Industrial area	75	70
(B)	Commercial area	65	55
(C)	Residential area	55	45
(D)	Silence zone	50	40

Note: -1) Day time shall mean from 6:00 am to 10:00 pm
2) Night time shall mean from 10:00 pm to 6:00 am
3) Silence zone is an area comprising not less than 100 meter around hospitals, educational institutions, courts, religious places or other localities declared by the competent authority.

These standards help to ascertain whether noise levels of an area/ are exceeding the permissible levels or not and accordingly noise mapping and planning of control measures can be implemented for reducing the effects of noise pollution. To minimize the impacts of noise pollution has on human health it is first necessary to find out the major source of noise pollution. Finding out the source of any pollution is known as 'source apportionment studies'. Source apportionment involves collection of information regarding how much a source contributes to the overall pollutant concentration. With the globalization, suburban areas around major cities in the world are expanding in terms of their city limits. Increasing city limits means an increase in the vehicular traffic due to the daily to and fro commutation of residential population. Thus, major objective of this research is to identify noise levels and the noise sources at three major junctions in Thane.

METHODOLOGY

STUDY AREA: Thane city is a satellite city of Mumbai (Maharashtra)and hence is significant residential location. In the past few decades, due to acute congestion near the station area residents started shifting towards city outskirts. Consequently, city outskirts are becoming

lavish localities withluxurious accommodations and private vehicles are adding to already overcrowding roads. Three sampling stations i.e. Teenhath Naka (TN), Kapurbawdi (KB) Junctions and Majiwada (MW) were selected for vehicle count and sound level study. At Teenhath Naka Junction two sites were selected due to heavy vehicular movement at the junction. Two sampling points were set at each location to measure the up and downward movement of vehicular traffic.

GPS Coordinates:

TN:19◦11’17.82”N72◦57’48.72” E

MW:19◦22’46.96” N 72◦58”39.08”E

KB: 19◦13’03.24” N 72◦58’47.90”E

Pic 1: Teenhath Naka (TN)

Pic 2: Study area

Pic 3: Majiwada (MJ) and Kapurbawdi (KB)

MEASUREMENT OF NOISE AND VEHICLE COUNT

The noise assessment and vehicular count was carried out during the peak hours from 8 am to 12.00 noon and from 7 pm to 10 pm. Noise was measured using Sound level meter (HTC SL-1352).‘A’ weighted scale was selected for the measurements of the noise levels as this scale filters out much of the low-frequency noise they measure, like the response of the human ear and were designated dBA. Vehicular count was carried out manually with the help of vehicle counter. The vehicle count data consisted of traffic volume and type of vehicles such as two-wheeler, three-wheeler, four-wheeler and heavy vehicles.

SOURCE APPORTIONMENT FINDING

Major source of roadside noise level is calculated by assessing vehicular congestion ratio and its percentages. Vehicular Congestion was calculated using vehicle count data, Passenger Car Unit and capacity of road.

Following formula was used to calculate vehicular congestion:

$$\text{V/C ratio} = \frac{\text{PCU/Hour}}{\text{Total capacity of road/hour}}$$ [9].

PCU/Hour = Passenger Car Equivalency * total traffic volume/hour [9].

Table 2: Recommended PCE values for different types of vehicles in urban roads [9]

Types of Vehicles	Passenger Car Equivalency (PCE)
Two-Wheeler	0.5
Three-Wheeler	1.2
Car	1
Heavy Vehicles	2.2

Table 3: Recommended design service volumes [9]

Types of road	Total Design service volumes of different categories of urban roads		
	Arterial*	Sub arterial**	Collector***
2-Lane (one way)	2400	1900	1400
2-Lane (two way)	1500	1200	900
3-Lane (one way)	3600	2900	2200
4-Lane undivided (two way)	3000	2400	1800
4-Lane divided (two way)	3600	2900	-
6-Lane undivided (two way)	4800	3800	-
6-Lane divided (two way)	5400	4300	-
8-Lane divided (two way)	7200	-	-

* Roads with no frontage access, no standing of vehicles, very little cross traffic. ** Roads with frontage access but no standing of vehicles and high capacity intersections. *** Roads with free frontage access, parked vehicles and heavy cross traffic.

RESULTS AND DISCUSSION

Thane being one of the major corridors connecting the suburban areas to the India's financial capital Mumbai, has experienced increase in the network of roads in and around the city. This has increased the vehicular movements on the roads of Thane. The noise levels for all locations were notably high as all the sampling locations are important junction point of the eastern express highway. The level of noise and reasons for such high noise levels were identified by analysing roadside noise levels and vehicle count data of all locations by considering different aspect.

COMPARISON OF NOISE LEVELS OF MULTIPLE LOCATIONS

Majiwada junction has the highest noise levels followed by Teenhath Naka and then Kapurbawdi Junction. Majiwada junction being the connecting link between the traffic from Western Express Highway and Eastern Express highway show higher noise level. The study showed that for peak hours, the noise levels for study locations during daytime ranged

between 72 dBA - 81 dBA and for night-time between 70 dBA - 80 dBA. There is no much difference between observed day time and night time noise level because at night there is continuous movement of multi axle good carriers to avoid passenger vehicles and signal congestion.

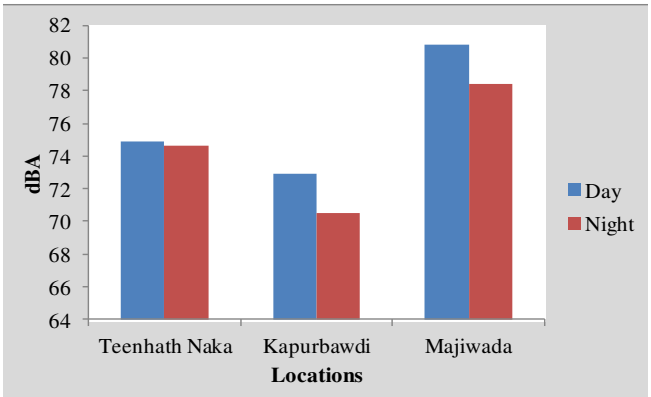

Fig 1: Comparison of noise levels of different locations.

All the sampling sites are affected by traffic noise and the noise levels for all the sampling sites are higher ifcompared with the permissible limits prescribed by Central Pollution Control Board (CPCB). Similar observations were made in studies at Gwalior, Srilanka, Nashik [14], [4],[17] where roadside noise level measured were in the range of 70dB to 90dB.

COMPARISON OF VEHICLE COUNT WITH NOISE LEVEL OF MULTIPLE LOCATIONS

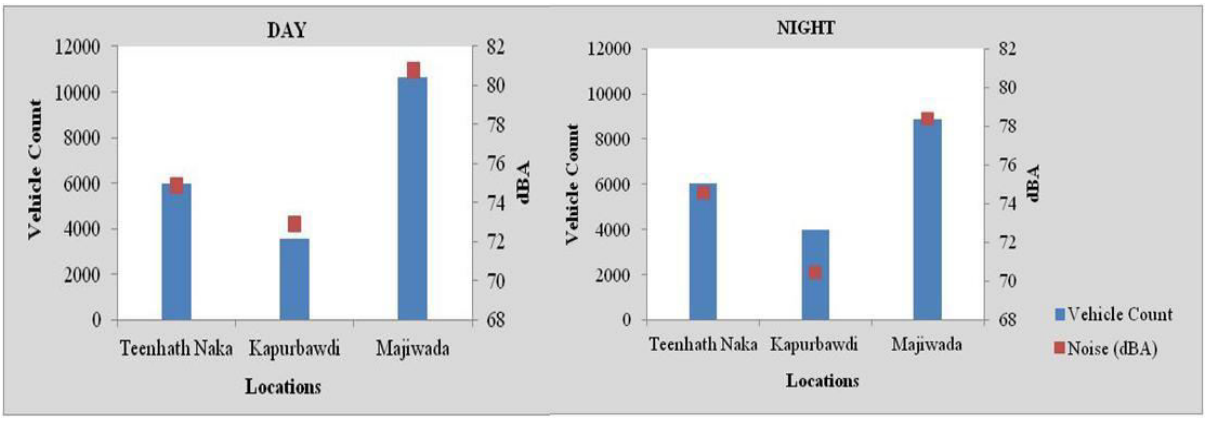

Fig 2: Comparison of vehicle count with noise levels of all locations.

Noise level of the area increased in proportion to vehicular count as vehicles contribute to it predominantly. It can be seen from the chart that, maximum noise and vehicle count is recorded at Majiwada junction for peak hours 8 am to 12 noon and 7 pm 10 pm, followed by

Teenhath Naka junction, and then by Kapurbawdi junction. A trend can be found in terms of vehicular noise level. Vehicle count and noise levels are directly related hence high vehicle count can results into higher noise levels and vice versa. Similar observation had also been made in a study carried out at Ahmadabad [8].

COMPARISON OF VEHICULAR CONGESTION AT MULTIPLE LOCATIONS

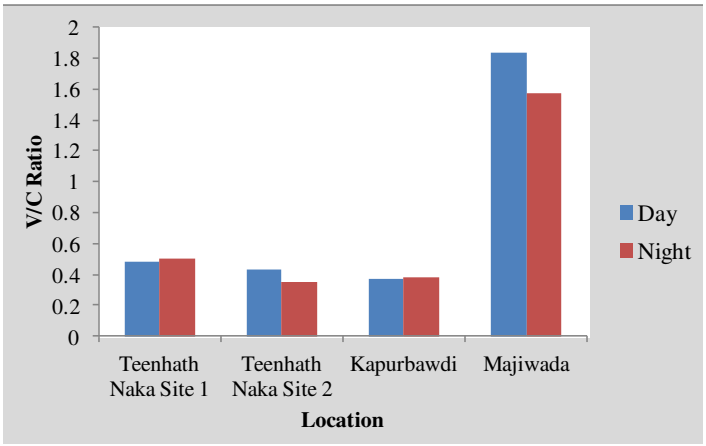

Fig 3: Comparison of vehicular congestion of different locations.

Majiwada junction faces maximum vehicular congestion followed by Teenhath Naka site 1, site 2 and Kapurbawdi Junction respectively. The reason for high vehicular congestion at Majiwada junction was construction of road. The location when studied was a 6-lane road with road widening work being carried out.

COMPARISON OF PERCENTAGE OF VEHICLE TYPES WITH NOISE LEVELS OF MULTIPLE LOCATIONS

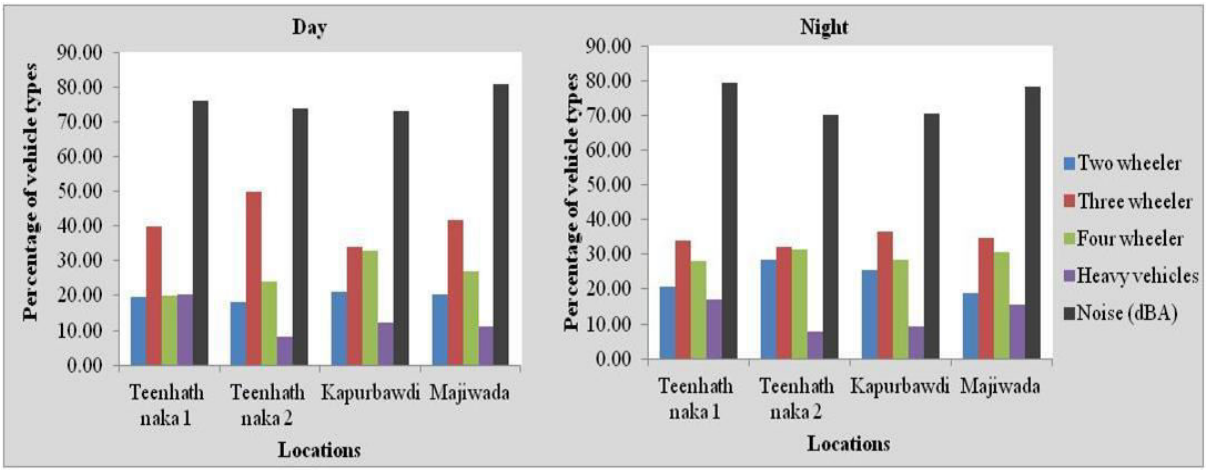

Fig 4: Comparison of percentage of vehicles based on VC ratio and noise levels(dBA)

It can be observed that maximum percentage of three wheelers were recorded at all locations for both time periods 8am-12pm and 7pm-10pm followed by other vehicle types. The percentage of three wheelers for Teenhath naka (2 sites) during day was observed to be 40% (Site 1), 50% (Site 2) and for night was 34% (Site 1), 32% (Site 2). For Kapurbawdi and Majiwada percentage of three wheelers during daytime was observed to be 34% and 42% and during night-time was observed to be 36% and 35%, respectively. Similar observation was made in a study carried out at Philippines and Srilanka [4] and [10], where high tricycle traffic (three wheelers) was said to be major contributor to roadside noise level.

CONCLUSION

Noise - an unwanted sound - which on extended exposure has been proved to have physical and psychological effects on wellbeing of humans. Thus, assessment of one of the major sources of noise pollution i.e. roadside noise was carried out to find the major contributor of roadside noise in Thane city. The study revealed that the noise level for the peak hours i.e.8am-12pm and 7pm-10pm are1.5 times higher than the standards prescribed by the Central Pollution Control Board, India for all the study locations. Maximum noise and vehicle count were recorded at Majiwada junction followed by Teenhath Naka and the least was recorded at Kapurbawdi junction. It became evident that at the increase in noise level is attributed to the large number of vehicles and it is also clear that with increase in vehicle number there is an increase in noise levels.

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