

MODELLING OF ROAD TRAFFIC NOISE IN SELECTED AREAS OF NASHIK CITY.

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Abstract—Most of the cities in India are facing serious noise pollution problems due to the concentration of motor vehicles and human population within the limited urban areas. The increase in noise pollution with increase in vehicular population is obvious. The study presents the status of noise pollution in selected areas of Nashik due to road traffic. The study was conducted using sound level meter at selected period of time and at selected locations. The study indicated that the noise levels in commercial areas, out of the study area under consideration, exceeded permissible levels. The results can be used for traffic management, land use planning and pollution control

Keywords- Passenger car unit (PCU) Equivalent sound energy level.

I. INTRODUCTION

Traffic noise tends to be a dominant noise source in our urban as well as rural environment. Noise is the undesirable sound. One measure of noise pollution is the danger it poses to health. Noise causes stress, can be the cause of illness and create annoyance. Therefore, any form of noise can be considered pollution if it causes annoyance, sleeplessness, fright or any other stress reaction.

Transport related noise pollution is a major threat in the urban areas. The response to noise pollution itself is highly subjective. Noise from motor vehicle while in motion is produced from different sources like, Engine, Exhaust, Horn and friction between tyre and roadway. It is learnt that the noise level in major cities or towns of India is exceeding the permissible limits. The population subjected to this noise level has got various health related complaints.

Nashik is one of the fast growing city in Maharashtra because of Industrial development and its connectivity to Mumbai, Pune, Aurangabad, etc. The city has more than 6 lakhs vehicles which are shared by 15 lakh population.

In this paper attempt has been made to study the noise levels due to traffic in selected areas of Nashik.

II. BACKGROUND OF NASHIK

Nashik have population of more than 15 lakhs. Its economy is driven chiefly by the engineering and manufacturing industry (which has been around since the seventies) as well as the progressive agriculture in area surrounding the city. Nashik is deemed "the third most industrialized city of Maharashtra after Mumbai and Pune", mainly due to extensive industrial development in recent times. In Maharashtra, "Nashik" is situated at a distance of approximate 200 km from economic capital of country Mumbai (Bombay) as well as Pune. The most important

feature of Nashik city is that the NH-3 i.e. the Mumbai-Agra National highway passes through the heart of the city. Nashik became an obvious choice for setting up industries to budding entrepreneurs after Mumbai, Pune and Thane belts. Nashik is an apex of the golden triangle of Maharashtra. Nashik is one of the important holy places in India. MahaKumbh takes place at Nashik which attracts floating population of 8 to 10 lakhs.

III. NOISE LEVEL PARAMETERS

The noise source is found to be strongly time dependant. The noise level is very high or very low for a given time interval. During peak hours it is exceptionally high. Under such circumstances a single value, which is representative of all the noise levels occurring over a given span of time, need to be calculated. The common traffic noise descriptions are L_{10} , L_{50} , L_{90} and L_{eq} .

Where L_{10} :- Noise level which exceeds 10 percent of the total observation time.

L_{50} :- Noise level which exceeds 50 percent of the total observation time.

L_{90} :- Noise level which exceeds 90 percent of the total observation time.

L_{eq} :- Equivalent sound energy level that is the a weighted energy mean of the noise level averages over the measurement period. It can be considered as the continuous steady noise, which would have the same total a weighted acoustic energy, as the real fluctuating noise measured over the same period of time.

The recommended noise standards for ambient air and for automobiles, domestic appliances and constructions equipment, which were later notified under The Environment (Protection) Act, 1986 as given below:

TABLE NO 1: AMBIENT NOISE LEVEL STANDARDS

Area Notation	Category of Area	Limit in dB(A), Leq	
		Day Time*	Night Time**
A	Industrial Area	75	70
B	Commercial Area	65	55
C	Residential Area	55	45
D	Silence Zone***	50	40

* Day time 06 am to 09 pm

**Night time 09 pm to 06 am

***Areas up to 100 m around certain premises like Hospitals, Educational institutions and Courts may be declared as silence zone.

IV. METHODOLOGY

Keeping in view the objective of the study, a field data collection programme was designed to collect data regarding the following parameters. Four locations were selected on the basis of different land use like commercial, Heavy traffic, silence and Residential Zones.

The locations are as shown below,

Locations	Type of zone
Civil Hospital, Nashik	Sensitive zone
Pandit Colony	Residential zone
Mahatma Gandhi Road	Commercial Zone
Gangapur Road	Educational Zone

The data pertaining to traffic studies and noise levels were collected at these locations. The required data has been collected for different hours of the day such as morning, afternoon and evening.

The data on following parameters was collected

1. Classified traffic volume
2. Ambient noise level
3. Geometric parameters like road width, number of lanes, lane width, shoulder width, presence of median, footpath, gradient, curve etc.

Traffic studies: The traffic characteristics were determined by carrying out the following studies

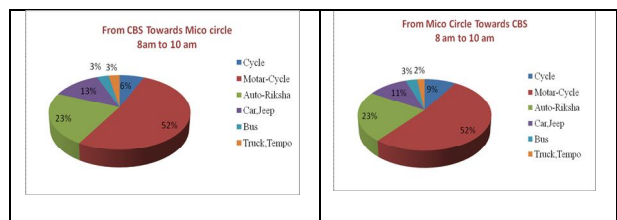
1. Traffic volume studies.
2. Traffic speed studies.

Traffic volume studies : The unrestricted mining of different classes of vehicles in the traffic stream forms the mixed traffic flow on the road. Since the different classes of vehicles use the common roadway facilities without segregation on the highway, therefore traffic flow becomes heterogeneous and hence, it is required to convert all the categories of vehicles into a single unit called passenger car unit (PCU) as per IRC guidelines. The flow is then expressed as PCU per hour. The traffic volume data was collected on hourly basis on both the directions

for six hours of the day such as 8am to 10 am, 1 pm to 3 pm and 5 pm to 7 pm.

TABLE NO. 2: TRAFFIC VOLUME STUDIES (AT TRIMBAK ROAD)

Direction of flow(From CBS towards Mico circle)					Direction of flow (From Mico circle towards CBS)			
Time → Vehicle ↓	8-10 am	1-3 pm	5-7 pm	PCU	8-10 am	1-3 pm	5-7 pm	P CU
Cycle	217	94	194	252.5	324	118	340	391
2 wheeler	1753	2715	2922	3880	1949	3185	3547	4340.5
Auto rickshaw	769	841	933	2703	849	914	945	2708
4 wheelers	431	829	644	2124	414	789	730	1933
Bus	104	93	01	894	121	83	127	993
Truck/ Tempo	96	90	7	669	77	95	73	735
Total PCU	2785	3623.5	1114		2993.5	888.5	4218.5	

**Fig. No.1 Composition of traffic**

Traffic speed studies :

The speed measured at any particular location will depend upon a number of factors such as type of road, geometric elements, physical and environmental conditions, volume and composition of traffic. Manual method as used consisted of using stop watches and noting down the time to travel the distance between the two fixed points was kept as 50 m.

TABLE NO3:SPEED TABLE

Vehicle	Speed(km/hr) Near side	Speed(km/hr) Far side
Cycle	15.8	16.5
Two	29.8	28.2
Auto	26.4	27.3
Four	28.4	29.2
Bus	25.3	24.4
Tempo	31.8	30.9
Truck	26.8	28.3

Table No. 5: Traffic Volume

Sr. No.	Location	Volume of Traffic PCU/Hour	
		Maximum	Minimum
1.	Civil Hospital, Nashik	2109	1393
2	Pandit Colony	342	196
3	Mahatma Gandhi Road	1495	604
4	Gangapur Road	1726	1151

Noise pollution studies :

The noise pollution parameters were recorded at the selected locations. Sound Level Meter (SLM) model SLM 100 (Envirotech make) was used for measuring the noise levels. The instrument was kept at an height of 1.5 m from ground level and at a distance of 5 m from the pavement edge with the microphone pointing towards the noise source. The instrument allows user to select slow or fast mode of measurement. The instrument continuously displays sound pressure level (SPL), Equivalent sound level (LEQ), Maximum and minimum SPL and Sound Exposure level (SEL) integrated over the duration of operation.

TABLE NO. 4: NOISE LEVEL

Location	Date	Period	Leq max. (dBA)	Leq min. (dBA)
Trimbak Road	03Fe b.2011 (Thus day)	8-10 am	84	74.7
		1-3 pm	73	63.4
		5-7 pm	73	79.3
	06Fe b.2011 (Sunday)	8-10 am	82	63.7
		1-3 pm	72	64.7
		5-7 pm	80	69.2
	07Fe b.2011 (Monday)	8-10 am	84	65.2
		1-3 pm	74	62.2
		5-7 pm	78	72.9

2. Traffic Speed:**TABLE NO. 6: AVERAGE SPEED**

Sr. No.	Location	Average Speed of Traffic Km/h	
		Near side	Far side
1.	Civil Hospital, Nashik	27.35	26.72
2.	Pandit Colony	25.67	26.10
3.	Mahatma Gandhi Road	10.00	10.00
4.	Gangapur Road	27.00	27.10

3. Noise Pollution :

The noise levels Leq, Lmax, Lmin and SEL were recorded with the help of Sound Level Meter at an interval of 1 minute. The peak noise levels represented as Leq were The Leq at Civil Hospital Area. were between 84.5 dB to 62.2 Db. The Leq at Pandit Colony Area. were between 82.1 dB to 66.2 dB

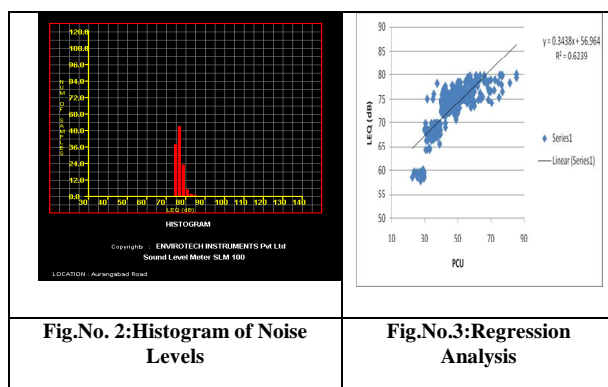
The Leq at Gangapur Road were between 82.1 dB to 66.2 dB.

For Mahatma Gandhi Road it was between 84.5 dB to 62.2 dB.

A direct co-relation between traffic volume and noise level was observed at both sites.

4 .Linear Regression Analysis

An attempt has been made to develop a regression model for different locations under study, to find out the relation between traffic volume and noise levels. For this minutely traffic volume and noise levels were recorded. The following table shows the regression equations for different locations.

**V. RESULTS AND DISCUSSION****1. Traffic Volume :**

The total volume of vehicles per hour was calculated by converting the traffic volume into Equivalent passenger car units and the total PCUs per hour were calculated as shown.

Location

TABLE NO. 7: REGRESSION ANALYSIS

Location	Period	Equation	R ² Coefficient
Trimbak Road	Morning	$Y=0.343X+56.96$	$R^2=0.623$
	Afternoon	$Y=0.175X+64.08$	$R^2=0.527$
	Evening	$Y=.422X+45.83$	$R^2=0.608$

CONCLUSION

1. Almost in all the areas under study, noise level exceeds the permissible limits specified by central pollution control board (CPCB).
2. In residential area existing noise levels are very close the levels specified.
3. In silent zone that is civil hospital area, the noise levels are far more than the specified, which is a serious concern.
4. As expected noise level in commercial zone are exceeding permissible limit.
5. R² Value Varies From 0.505 To 0.623. This show the corelation between traffic volume and noise levels.
6. Average speed of the traffic at Mahatma Gandhi Road, which is commercial zone is very low as 10 kmph and for Civil Hospital Area road it is about 27.35 kmph. It seems that road geometrics affect the speed and noise level.

The above model could be used with slight modifications, for traffic planning and pollution control in urban area.

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