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Noise Mapping in Mumbai City, India.

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Abstract:

Noise Mapping is a study made to differentiate the city into zones according to different Noise levels. It records Noise as is actually present in a location and compares it to the ideal noise levels, as stipulated by the standards given. A study was conducted on the roads of Mumbai city using a Sound Level Meter (SLM). This data was tabulated to demarcate the city into different noise zones. The Leq, Noise Climate, and Noise pollution levels were calculated . This was further represented in the form of cartographic maps for easy understanding. It was found that the noise levels in overall city were very high and above the permissible limits. The average values throughout were 70-80dB.

Keywords: Noise Mapping, Sound level meter, Leq, NC, Lnp, Cartographic map representation of the data

1. Introduction:

The city of Mumbai is a commercial capital of India with massive development projects both infrastructural and commercial types taking at a very fast pace. There is an increase in the noise produced on a daily basis. Mumbai is the 3rd noisiest city in the world .Studies on noise pollution was undertaken by maharshtra pollution control board , and central pollution control boards . Regular monitoring however is undertaken only during festival days by these governemttn agencies . in the past non governmental agencies like the “Awaaz” had monitored noise. The first study was carried out by Vyas (2002) and second such study was conducted by Sumaira Abdul Ali (April 2006) with the support of MMDRA, her project was entitled ‘The Mumbai City Noise Mapping Project ’. Lot of Geographical work concerning noise has also been done including noise mapping by Vyas (Vyas, 2002). Noise Mapping makes the government aware and hence enables them to take suitable measures in reducing it, thus leading to proper town planning. The idea of Noise mapping was 1st undertaken by Defra, a private research organisation in Europe. In India this is fairly a new concept. Noise mapping data can be provided to the relevant authorities for the implementation of right rules and regulation and acts as a basis for future action plans. It is also a great source of information to the citizens. The basic requirements for strategic noise mapping are an existing or a previous or a predicted noise situation, the exceeding of a limit, the estimated number of people location in an area exposed to certain levels of noise, estimated number of dwellings, schools and hospitals in a certain area exposed to specific values of noise indicator. The city of Mumbai has different landuse patterns with the eastern parts being more industrial, south Mumbai commercial, central Mumbai being congested and western suburbs a conglomerations of various developments. The traffic pattern and types of vehicles too differ in various parts of the city, with restrictions of public autorickhshaws in the suburbs . Thus it became imperative to study noise levels in the study on a large scale and identify the critical areas.

Along with other types of pollution, noise has become a hazard to quality of life (Davar, 2004). Various studies have revealed that noise levels in some of the Indian cities are higher than the standards prescribed by CPCB, Central Pollution Control Board and MoEF, Ministry of Environment and Forest, Govt. of India (Naik, 1999; Mohan, 2000; Gupta, 2003; CPCB, 2012; Joshi, 2012; Mangalekar, 2012; Kumar, 2001). Several studies have been carried out in India on noise levels, noise climate, *Leq,* and L_{max} (Nikhil kumar *et al,* 2013; Chaudhary*et.al,* 2012; Tandel, 2011).

The objective of the study is to assess the noise pollution levels, noise climate, *Leq,* and L_{max}, Noise Pollution Level Index and Noise Climate in this city and construct a noise map.

2. Materials and Methods:

Noise levels at different places were recorded using basic Sound Level Meter (Model no. SL-4010) on 15th March2012 . The route followed was from Churchgate, Mumbai, India upto Andheri, Mumbai India. A road parallel to the western railway line was studied(Table 1.1). This was maintained to avoid any interferences of rail noise. When the instrument was switched on, a range was selected which was ideal for the surrounding. (The instrument has 3 ranges 35-80dBs, 50-100dBs and 80-130dBs). After the selection of the range the microphone was pointed or faced towards the traffic, which was the noise source. Since the instrument showed fluctuating values depending on the changing noise levels, a method was devised to maintain uniformity. Readings were recorded after every 10 secs. After 10 secs whatever value was displayed on the SLM screen was noted down. Three such readings were noted to calculate the average value. The data was further used to calculate Leq (Eq.1), Noise climate (NC) (Eq. 2) and Noise pollution level (Eq. 3) (Ehrampoush M., 2011). A city noise map was prepared. This Data was used for making Isopleth maps. Different symbols were used to indicate the different range of noise pollution levels and a noise map is constructed (Fig. 1.0).

L_{eq} was calculated using following formula.

$$Leq,T = 10\ log[1/n \sum_{i=1}^{n} 10^{Li/10}] \ldots\ldots\ldots (1)$$

Where, L_{eq} = noise levels observed in time interval T and n= n^{th} duration of measurement

L_{eq} is the equivalent continuous equal energy level; and can be applied to any fluctuating Noise Level. It is that constant Noise Level that over a given time expends the same amount of energy as the fluctuating level over the same time period. (MPCB, 2005.,P. Saler, 2012).The readings noted in fractions, were rounded off to nearest integer in the observation tables. To detect the actual rise in the noise level a set of readings was taken on a normal working day. To get better understanding of noise range noise climate (NC) index (Pathak, 2008) was calculated using following formula:

$$NC= L_{10} - L_{90}\ dB\ (A) \ldots\ldots\ldots\ldots\ldots. (2)$$

Total annoyance caused by noise level was estimated using noise pollution level index (NP) (Ehrampoush M., 2011)

$$LNP= Leq * 2.56\partial \ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Where, L_{NP} = Noise pollution level, L_{eq} = equivalent noise level, ∂= standard deviation

Statistical analysis was carried out to analyse the significant difference between festive and a non-festive day.

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Results and Discussion:

Table 1.1 Noise Levels in dB, Noise Climate and Noise Pollution Levels in the study .

Sr No	Location	Highest value	Lowest Value	Average (dB)	Std Dev + or -	Std Error	Variance	Leq	NC	Lnp (NPL)
1	Churchgate	80.6	64.5	72.00	3.06	0.38	9.38	79.65	8.02	87.49
2	Marine Lines	80.3	70	75.68	2.31	0.36	5.35	80.69	5.89	86.61
3	Charni Road	82.5	70.2	75.42	2.34	0.30	5.45	82.10	5.37	88.08
	Grant Road	91.4	59.9	71.00	5.93	0.77	35.19	82.97	13.46	98.15
5	Mumbai Central (Tardeo)	84.3	62.3	71.24	5.07	1.31	25.74	74.90	14.50	87.89
6	Haji Ali	84.2	66.3	74.18	4.68	1.10	21.89	77.47	13.76	89.45
7	Mahalakshmi	94.0	63.2	74.97	6.67	0.84	44.51	87.36	17.66	104.44
8	Dr. E. Moses Road	86.6	64.7	75.26	5.85	0.97	34.20	82.91	18.17	97.89
9	Lower Parel	104.0	68.8	78.03	6.55	0.79	42.89	94.02	15.90	110.78
10	Matunga	89.7	66.5	74.80	4.30	0.33	18.52	88.14	12.14	99.16
11	Mahim	85.9	63.3	73.55	4.43	0.41	19.59	88.14	11.30	99.47
12	Turner Road (Bandra)	94.9	61.0	75.04	5.18	0.59	26.80	86.63	13.15	99.88
13	Bandra (W) SV Road	86.7	72.1	79.04	4.59	1.33	21.08	80.13	13.40	91.89
14	Khar(W) SV Road	91.6	62.9	75.86	5.67	0.67	32.14	86.70	13.21	100.84
15	Santacruz(W) SV Road	120.0	59.9	79.52	6.80	0.60	46.25	108.32	13.50	125.73
16	Vile Parle(W) SV Road	95.5	61.0	80.76	4.78	0.51	22.83	90.89	10.72	103.12
17	Andheri(W)	82	79.3	80.7	0.86	0.19	0.73	82.20	2.39	84.39
18	Mulund(W), J.S.D Road	74.8	56.5	67.44	5.94	0.89	35.34	74.95	16.04	90.00

As seen in table 1.1 the average noise values seen throughout the study area are above 70dB. The highest average value seen is 95.5 dB in Vile Parle area (avg80.76dB).The possibility of higher readings is due to its close proximity to the airport and also high density of autorickshaws running on this road. This area also shows maximum deviation from the noise values. Other such deviation in noise levels is also seen at Lower Parel and Mahalakshmi, these areas are in a busy commercial zone of the city. Noise pollution levels are seen very high at Santacruz with noise level of 120dB, followed by Lower Parel with a noise level of 104 dB. Similarly higher Leq values are seen at both these locations. The location Santacruz is at close proximity to the domestic airport, where as Lower parel shows increase in malls along with the already existent Industrial area. The noise pollution levels at all the sites were above 75, thus belonging to extremely risky conditions (Banerji, 2009). The noise pollution levels in Churchgate, Marine lines and Charni road showed comparatively low values. In these areas autorickhshaws are not allowed to run, and there are restrictions for heavy vehicular movements. The noise climate too showed the same trend in the above areas. Noise map is represent in figure 1.3 using the noise pollution levels in table 1.1. Different symbols are assigned to the 5 different categories of risk. The city experiences high levels of noise throughout the study.

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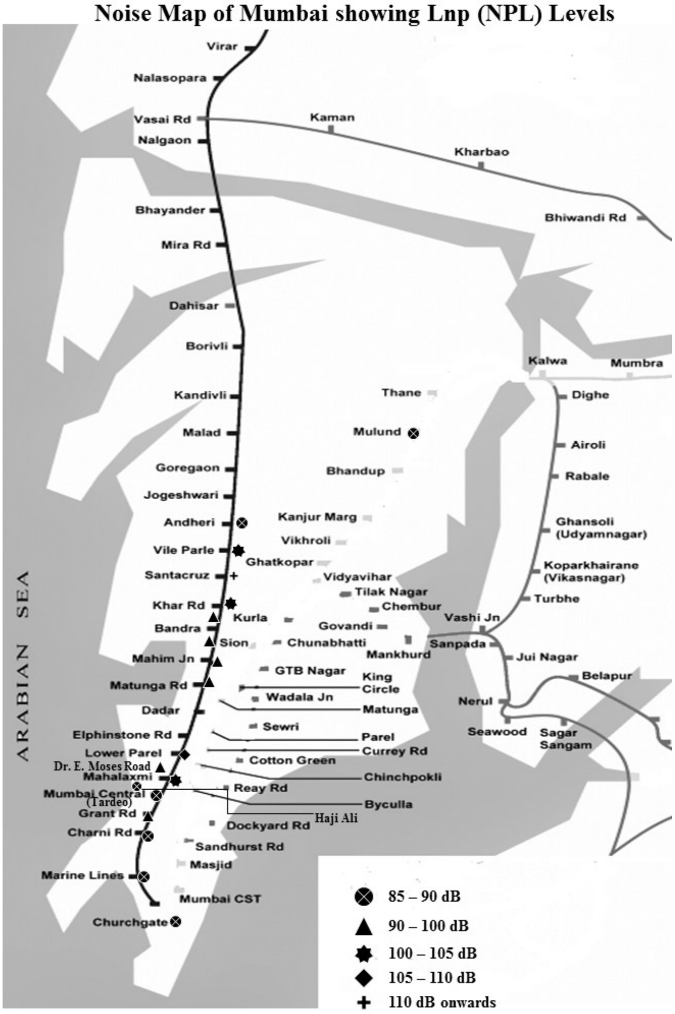
Fig 1.0 Showing noise pollution levels for survey carried out from Churchgate to Andheri



Conclusion

Certain rules need to be followed about noise maps to enable public participation. Public awareness needs to be created to keep the noise levels within the permissible limits. Different parts of the city showed different patterns of noise levels and noise climate. However it is evident that the city experiences high levels of noise pollution.

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