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A pilot study on the establishment of national ambient noise monitoring network across the major cities of India

N. Garg [a,*], A.K. Sinha [b], V. Gandhi [b], R.M. Bhardwaj [b], A.B. Akolkar [b]

[a] CSIR-National Physical Laboratory, New Delhi 110 012, India
[b] Central Pollution Control Board, Parivesh Bhawan, East Arjun Nagar, Delhi 110 032, India

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ABSTRACT

The paper describes the pilot project on the establishment of National Ambient Noise Monitoring Network (*NANMN*) across seven major cities in India for continuous noise monitoring throughout the year. The annual average L_{day} (06–22 h) and L_{night} (22–06 h) values observed since past three years are described. The long-term noise monitoring shows that ambient noise levels have marginally increased since past three years in the 35 locations under study in which 14 locations are in commercial zone, 5 in Industrial, 7 in residential and 9 in silence zones. The study is very helpful in ascertaining the magnitude of annual average ambient noise levels, planning for noise abatement action plans and formulation of revised ambient noise standards in Indian scenario.

1. Introduction

Noise pollution has become a serious concern globally. Every nation is concerned toward the health effects of noise emitted from the expanding number of vehicles moving on the roads. It is thus imperative to adopt long-term noise monitoring strategies to monitor the noise levels and planning of suitable noise abatement measures for noise control. The European Environmental Noise Directive 2002/49/EC require that the noise maps should present the noise levels expressed in harmonized indicators: day–evening–night level, L_{den} and night equivalent level, L_{night} [1]. The Directive articulates the assessment methods and their timing for the purpose of strategic noise mapping and their corresponding action plans which implies the use of harmonized indicators and evaluation methods as well as criteria for noise mapping [2]. There have been many such studies reported across the globe for monitoring the ambient noise [3–21]. The road traffic noise has been observed to be the major source of noise pollution in most of these studies carried out in the different parts of the world. Also, there have been few studies focussed on sampling strategies for the measurements to be conducted as a substitute to the long-term noise monitoring [22–26]. Thus, it is imperative to adopt continuous long-term noise monitoring for ascertaining the magnitude of ambient noise levels and comparison with the established noise limits. The health effects of the exposure to high ambient noise levels can be severe and as such many studies have investigated annoyance and health related effects caused by exposure to the high ambient noise levels [27–33]. There has been no such comprehensive long-term noise monitoring study previously reported in India. Apart a validated road traffic noise model useful in conducting Environmental Impact Assessment studies in respect of noise similar to that used in developed nations is required in Indian conditions [34,35]. The Central Pollution Control Board (CPCB), New Delhi has taken many initiatives and carried out numerous studies for monitoring the ambient sound levels at noise hot spots in metropolitan cities like Delhi city for the implementation of suitable measures for noise mitigation. CPCB, India initiated the process of developing National Ambient Noise Monitoring Network (*NANMN*), a follow-up of Section 5.2.8 (IV) of National Environmental Policy (NEP)-2006, through which it was decided to include ambient noise as a regular parameter for noise monitoring in urban areas [36,37]. The noise pollution norms were framed under Regulation and Control Rules 2000 by Government of India. Accordingly, Noise Pollution (Regulation and Control) Rules 2000 has been amended vide S.O. 50 (E) dated 11.01.2010 with the title "The Noise Pollution (Regulation and Control) (Amendment) Rules, 2010". In order to implement these regulations effectively, it was felt necessary to monitor the noise levels in different cities continuously. The real time noise monitoring network, *NANMN* project was established with an objective of collecting the real-time continuous noise monitoring data. A turnkey solution has been implemented that includes the real-time data acquisition, communication, analysis and display system for effective noise

* Corresponding author.
E-mail address: ngarg@nplindia.org (N. Garg).

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monitoring at the sensitive sites. The phase I of the Real Time National Ambient Noise Monitoring Network was established in year 2011 that covers 35 locations in seven metro cities (Delhi, Hyderabad, Kolkata, Mumbai, Lucknow, Bengaluru and Chennai) and by phase II and phase III, 160 locations spread over 25 cities in 18 states will be established [38]. Although the continuous noise monitoring for such a long-term is cumbersome and expensive especially for developing countries like India, yet it is imperative to adopt this strategy for ascertaining the magnitude of ambient noise levels at sensitive sites and planning for noise abatement measures.

The present work describes about the pilot project on the establishment of National Ambient Noise Monitoring Network (*NANMN*) across the seven major cities in India for continuous noise monitoring throughout the year. The annual average L_{day} and L_{night} values observed since past three years are described. Out of these 35 locations in seven major cities of India, 14 locations lie in commercial zones, 5 in Industrial, 7 in residential and 9 in silence zones. Such as pilot study has been for the first time carried out in Indian scenario as earlier CPCB and State pollution control boards had been carrying out short-term sporadic or isolated noise monitorings in urban areas. The network will result in creation of the base line data and facilitate its analysis for policy makers and implementation agencies to take appropriate actions for noise control at regional and national level. The 35 locations are judiciously selected in the study based on the preliminary short-term noise monitoring surveys conducted by CPCB and State pollution control boards previously [39–43].

2. Methodology and instrumentation

The noise monitoring data analyzed are reported from CPCB noise monitoring stations established under *NANMN* project and situated at thirty five different locations all over India since the year 2011. Fig. 1 shows the schematic diagram of the ambient noise monitoring network. The real time ambient noise monitoring network consists of [38,44–46]:

- **Automatic Data Collecting Remote Stations** comprising of noise monitoring sensor, data logger, internal Global Positioning System (GPS), microprocessor, protection circuits, communication modem, power source including battery and charge regulator for solar panel or mains AC power supply.
- **Automatic Communication options for data communication** comprising of Transmission Control Protocol/Internet Protocol, TCP/IP (Telnet; Simple Mail Transfer Protocol, SMTP; File Transfer Protocol, FTP etc.), short SMS messages to mobile telephones for notices or alerts, Global System for Mobile Communication (GSM) modem, General Packet Radio Services (GPRS) modem, fiber optics, Radio-modem, Ethernet, Serial digital interface at 1200 baud (SDI-12), local area wireless technology such as Wi-fi, Bluetooth [47–49], satellite (internal or external transmitter).
- **Central Processing Station** comprising of hot redundant server, user workstations, software for data visualization and processing.
- **Web Enabled Software** for uploading on internet or sharing among CPCB and State Pollution Control Boards only to the authorized personnel.

The Noise Remote Terminal (NMT) manufactured and installed by Geónica Earth Sciences, Spain [46] is a standalone operating remote terminal consisting of a sound level meter traceable to the national standards for continuously measuring the ambient noise. Each terminal consists of a high quality outdoor microphones (Model: 41CN) connected to an advanced acoustic signal processing unit and a high resolution data logger. The outdoor microphone complies with IEC 61672 Class 1 requirements with either 0° and 90° reference direction. It has an electrostatic actuator for validity of the system functionality and has protectors for wind and dust protection, birds protections and humidity protection. The Noise Processor 2000 NP receives and digitizes the output signal generated by the microphone and computes the acoustic parameters such as L_{eq}, time, frequency weighting A and C and time weighting SLOW (S) and FAST (F). High resolution (via a 20 bit A/D converter) and very high storage capability (via 64 MB internal memory and optionally 2 GB SD card) are noteworthy features of automatic data acquisition unit. The sound level processor, Model 2000-NP has operating temperature range of −40 °C to +60 °C and humidity up to 100% R.H. The Data acquisition and transmission unit model 3008CP is connected to the 2000-NP analyzer through a RS232 or RS 485 port. The single PCB inside the 3008CP contains the power supply to be connected to the mains or to a solar panel. Optional meteorological sensors can also be connected to 3008CP unit for measuring temperature, atmospheric pressure, relative humidity, etc. The noise data along with data from other sensors if any is stored in the 3008CP unit, which is

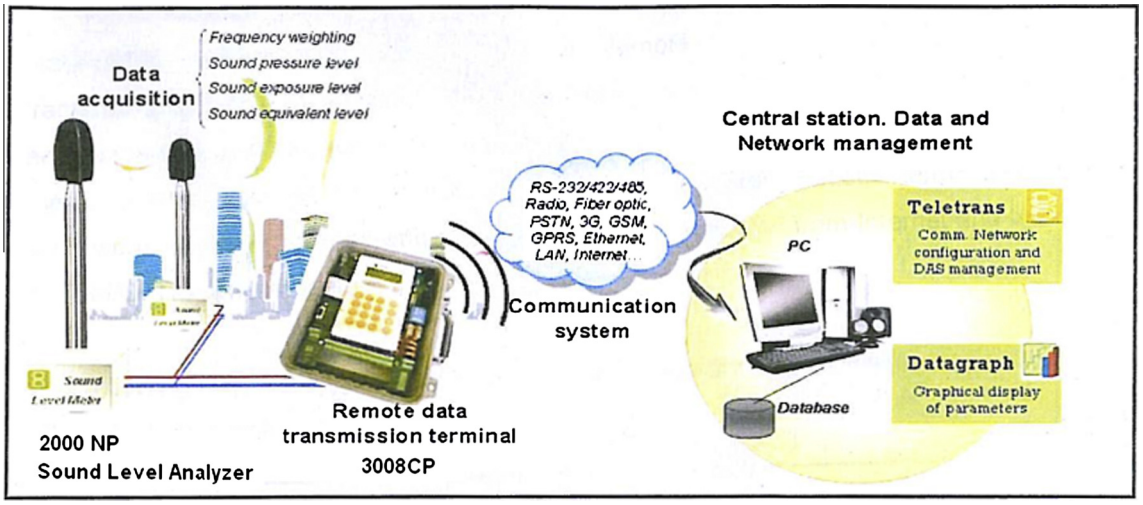

Fig. 1. Schematic diagram of noise monitoring system [45].