

# **Soundscape of Bhadrak Town, India: An Analysis from Road Traffic Noise Perspective**

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*Received May 1, 2010; revised and accepted May 15, 2011*

**Abstract:** The road traffic noise environment in Bhadrak, one of the district head quarters of Orissa in terms of standard noise indices, community response and community health effects are worked out in the present study. Noise pollution is analysed in five different squares (road sections) to assess the sound scape of the town. The sources of noise at the studied sites are predominantly attributable to motor vehicular traffic. Taking the tolerated noise level of 70 dB (A) during the day time on the main roads as standard for United Kingdom and many other European countries, in absence of regulation regarding permissible level for road traffic noise in India, the noise levels of all the five investigated locations were found to be beyond permissible limit during day time. Noise produced from cargo carrying trucks, bus, Bolero, trekker, motor cycle, tractor, dumper, tempo, ranges from 103.2–123.4, 101.2–118.3, 96.8–115.5, 98.3–113.2, 92.5–110.2, 106.4–116.5, 101.2–119.6 and 95.5–114.7 respectively. Thus, the contributions of individual vehicles towards noise pollution were found to be more than the road traffic noise-limit, i.e., 70 dB (A). A preliminary survey adopting questionnaire method amongst 256 local inhabitants has also been carried out to gather information about the suffering of people. The direct impacts include sleep disturbance, loss of concentration, annoyance and irritation, hypertension, high blood pressure, cardiovascular problem, restlessness, depression, fatigue and mental stress etc.

**Key words:** Road traffic, soundscape, noise pollution, Bhadrak.

## **Introduction**

The soundscape of a city is an important environmental reference of the quality of life in the urban setting. Canadian musician and composer Murray Schafer introduced the concept of “soundscape” (sound landscape) and its applicability in acoustic studies. According to him (Schafer, 2001), it is a sample of sound landscape classified as a field of study. Consequently, the analysis of all types of sounds in a given area or region is called soundscape. In the urban areas, the soundscape consists of environmental noise, particularly originating from vehicular traffic. The soundscape concept thus established gave rise to a new aspect for research of the sound environment and important studies have been carried out worldwide (Schafer, 2001; Zannin and Diniz,

2002; Hokao, 2004; Zannin et al., 2006; Szeremeta and Zannin, 2009).

Noise pollution is a significant environmental problem in many rapidly urbanizing areas. Noise has become an unjustifiable interference and imposition upon human health, comfort and quality of modern life. The increase in the number of vehicles is aggravating the situation day by day. Various noise surveys show conclusively that the road traffic is the predominant source of annoyance; no other single noise has been of comparable importance. The total horse power, which is ‘built in’ in automotive vehicles exceeds 20 times the horse power of all the other prime movers combined (air craft, ships and power stations) (Robinson, 1971; Roy et al., 1984; Ravindranath et al., 1989; Thakur, 2006). Except for some partial closure, none of the noise producing systems of the

vehicles has been fully enclosed. Thus, the noise emitted depends on the relative levels, characteristics and the interaction of the directly radiated noises from these systems. The power unit of vehicle and its auxiliaries act as principal noise source. The other important generators of noise are the transmission system, tyres and braking system (Cohn and Meroy, 1982; Dixit et al., 1982; Anonymous, 2000; Chakraborty et al., 2002; Banerjee and Chakraborty, 2006).

In India, some studies on the traffic noise monitoring have been carried out at different cities like Delhi, Bombay, Visakhapatnam, Baroda, Anantpur, Asansol, Nagpur, Chennai, Lucknow, Burdwan, Jharsuguda Balasore, and so on, and the average noise levels in these cities have been found to be more than the recommended value (Pancholy et al., 1967; Kadiyali, 1978; Prabhu and Chakraborty, 1978; Cohn and Meroy, 1982; Dixit et al., 1982; Roy et al., 1984; Rao et al., 1987; Ravindranath et al., 1989; Kudesia and Tiwari, 1993; Kumar and Jain, 1994; Pamanikabud and Chairsi, 1999; Anonymous, 2000; Chakraborty et al., 2002; Pandya and Dharmadhikari, 2002; Nirjar et al., 2003; Banerjee and Chakraborty, 2006; Thakur, 2006; Datta et al., 2006; Kisku et al., 2006; Krishna Murthy et al., 2007; Goswami,

2009). Besides the studies of Patel et al. (2006) and Goswami (2009) on Jharsuguda and Balasore respectively, the traffic noise environment in major cities of Orissa in terms of standard noise indices, community response and community health effects have not been studied till date. Only there were records of high level of dissatisfaction due to noise incidence in the cities of Orissa. On continuation with the study of Goswami (2009), a similar attempt has been made in this study to record the road traffic noise levels at twenty different places around five important squares to assess the local soundscape of Bhadrak town. Bhadrak town is geographically located at latitude  $21^{\circ}3'35''$  north of the Equator and longitude  $86^{\circ}31'11''$  east of the Prime Meridian on the world map (Figure 1). Noise pollution is assessed in different squares along the road from Ranital to Banta *Chhak* within the Bhadrak township. Due to the rapid urbanization around Bhadrak (one of the largest railway stations and one of the district head quarters of the state), there is increase in number of floating population and in number of vehicles including heavy truck, bus, dumper along this road. It has inevitably caused major noise pollution problems in the residential areas along this important road. The objective of the study



Figure 1: Map of India showing location of Bhadrak town (study area).

is to assess the level of noise exposure and its impact on residents residing around the vicinity of urban highway and railway platform. Along with the measurement of road traffic noise levels at the selected places, the impact of noise on the residents of those places has also been recorded. In short, this study assesses the soundscape of Bhadrak based on acoustic field measurements and on interviews with the local inhabitants to ascertain how they perceive their soundscape.

## Methodology

### Study Sites

Bhadrak is a coastal district of Orissa, adjoining to Jajpur and Balasore districts. Bhadrak town is the district head quarters through which NH-5, from Chennai to Kolkata, passes. Noise pollution is assessed in five different squares such as Charampa, Bypass *Chhak* (Square), Naya Bazaar, College *Chhak* and Kacheri Bazaar along the road from Ranital to Banta *Chhak* (NH-5). Noise pollution is assessed and analysed in these squares (road sections) of the investigated area (Table 1). As there is no defined basic noise levels on the roads prescribed by Central Pollution Control Board (Anonymous, 2000), India; the detected noise levels of the study area in day time are compared with the prescribed basic noise level (tolerance limit) on roads (traffic noise) during day-time at United Kingdom, i.e., 70 dB (A) (Table 2) (Krishna Murthy et al., 2007).

### Measurement of Road Traffic Noise Level

The noise levels were measured at all these five sites during their busiest hour with the help of a portable precision digital sound level meter (Model-SL-4001, made in Taiwan). This instrument is primarily designed for community noise surveys. A large digital display gives a single value indication of the maximum 'A' weighted RMS (root mean square) sound pressure level measured during the previous second. It is equipped with high sensitivity Bruel and Kjaer prepolarized condenser Microphone Type 4176. Measurements from 30 to 135 dB (A) can be carried out with this instrument. The instrument calibration was achieved using pistaphone calibrator capable of producing known sound pressure level, supplied by the manufacturer.

The noise levels were measured following standard procedure using calibrated sound pressure level (dB) meter in the month of April 2010 during day-time, at five different sites along the investigated road of 16 km predominated by both commercial and residential tenements, particularly reflecting motor vehicular traffic prone areas. 120 measurements were made within two hours duration (at one minute interval) in two specified times, i.e., from 9 AM to 11 AM and 5 PM to 7 PM in all the 20 investigated locations. All the sites chosen were unique having typical road width, road side housing pattern, traffic flowing pattern in different directions and also other socio-cultural activities.

**Table 1: Details of noise assessment sites**

No.	Assessment location	Number of spots of noise assessment	Remarks
1	Charampa	4	On each spot, the measurements were taken at sixteen different times during day-time.
2	Bypass <i>Chhak</i>	4	
3	Naya bazaar	4	
4	College <i>Chhak</i>	4	
5	Kacheri Bazar	4	
Total number of spots		20	

**Table 2: Tolerated noise levels on the main roads for United Kingdom (Krishna Murthy, 2007)**

Type of noise	Tolerance limit in dB (A)	
	Day	Night
Basic noise level	70	65
Frequent peaks	80	70
Infrequent peaks	90	80

### Evaluating Impact of Noise on Public Health

To delineate the perception about the noise and its significance on health of community, a representative sample of public (256 local inhabitants) were interviewed using a questionnaire on different dates in the month of April 2010. The questionnaire was drafted in order to detect the public's degree of tolerance and awareness to transport related noise with consideration to various parameters such as location, age of respondent, occupation and a number of general psychological, personal as well as physical aspects. The perception survey was carried out to indicate high prevalence of sleep disturbance, cardiovascular problems, hypertension and restlessness etc. It is pertinent to mention here that the interviewees were not asked specifically about the sound level of the road traffic noise, but the question considered the volume of the soundscape as a whole.

## Results and Discussion

### Noise pollution Assessment at Charampa

The traffic noise is measured at four different spots along the highway at and around Charampa, which are commercial in nature (Table 3). Bhadrak Railway station (one of the largest stations in the state) is also located at Charampa. Thus, there is rush of thousands of people throughout the day and night. The minimum and maximum noise levels observed at the highway around Charampa are 76.4 dB (A) and 129 dB (A) respectively (Table 3). The source is predominantly attributable to motor vehicular traffic. The permissible level for road traffic noise is 70 dB (A) (Table 2, Krishna Murthy et al., 2007) and the average recommended noise level in residential area and commercial area during day time are only 55 and 65 dB (A) respectively (Anonymous, 2000). In all the locations, the noise level has surpassed the permissible limit. It is pertinent to mention here that all the observations are made during daytime.

### Noise Pollution Assessment at Bypass *Chhak*

The name itself suggests that bypass is the diversion point from NH-5 to Chandbali. This is the entry point to Chandbali, an important port in Orissa; to Gahirmatha, a crocodile sanctuary and to Bhitarkanika, a National park. Chandbali port occupies a distinct place in Orissa's trade and navigation. Every day thousands of visitors go to Bhitarkanika. Hundreds of cargo carrying trucks and dumpers run to Dhamara Port along this road. The minimum and maximum noise levels observed at the highway around Bypass are 73.1 and 118.6 dB (A) respectively (Table 3).

### Noise Pollution Assessment at Naya Bazaar

Naya Bazaar is the centre of Bhadrak town. Bhadrak district is police headquarters as well as Bhadrak district hospital are located near Naya Bazaar. Naya Bazaar is famous for Mahatab Kothi (former freedom fighter and chief minister of Orissa), where Gandhiji stayed for one night during Quit India Movement. Gandhiji addressed a rally near Naya Bazaar, which is popularly known as Gandhi padia. Hundreds of tourists visit Mahatab kothi and Gandhi Padia daily. In this filed, most of the public meetings, rallies, election campaign are generally organized. This is the central business area of Bhadrak town. All the big shopping establishments are located here.

In order to investigate the effect of noise levels along the Naya Bazaar, the noise levels have been measured in the four nearest sites at and around the bazaar. Traffic rush and jam is very common along this road. Over all noise levels in the vicinity of Naya Bazaar ranges from 77.5 to 114.7 dB (A) (Table 3).

### Noise Pollution Assessment at College *Chhak*

This area is mainly populated due to the presence of a lot of educational establishments. Bhadrak Autonomous College, Bhadrak Junior College, Bhadrak Girls' High School and +2 Commerce College are situated here. This area is populated with student community. The traffic noise is measured at the four spots along the highways at and around College *Chhak*. The data are presented in Table 3. The minimum and maximum noise levels observed at the roads of four different spots around College *Chhak* are 74.7dB (A) and 118.7dB (A) respectively (Table 3).

### Noise Pollution Assessment at Kacheri Bazaar

Kacheri Bazaar is situated near NH-5 and this is the place where Bhadrak main bus stand is located. This place holds key communications to state capital as well as to all the villages and small towns in Bhadrak district. Bhadrak district court is situated at Kacheri Bazaar. The famous Maa Bhadrakali temple is nearer to this place. The Ferrochrome plant is within 2 km of this place. In order to investigate the effect of noise levels along the Kacheri Bazaar, the noise levels have been measured for the four nearest sites. The data are presented in Table 3. Overall noise level in the vicinity of Kacheri Bazaar ranges from 78.7 dB to 128 dB (A) and are more than the prescribed permissible limit.

Moreover, individual contribution to environmental noise by the air horn of different motor vehicles has been assessed at and around Bhadrak. A noise of short duration

(typically less than one second), particularly of high intensity, such as that produced by an air horn by any vehicle, occurring at regular or irregular intervals is known as episodic and impulsive noise. The episodic and impulsive noise levels of different types of vehicles are presented in Table 4. Noise produced from cargo carrying trucks, bus, Bolero, trekker, motor cycle, tractor, dumper, tempo, ranges from 103.2–123.4, 101.2–118.3,

96.8–115.5, 98.3–113.2, 92.5–110.2, 106.4–116.5, 101.2–119.6, and 95.5–114.7, respectively. The findings of individual contribution of vehicle towards noise pollution are more than the traffic noise limit, i.e., 70 dB (A).

The present study also explicitly demonstrates that the noise levels are more than the permissible limit in all the five squares including 20 locations/sites. However,

**Table 3: Traffic noise in Bhadrak along Charampa, Bypass *Chhak*, Naya Bazar, College *Chhak* and Kacheri Bazaar**

No.	Location	Number of observations	Sound pressure level in dB (A)	
			Min	Max
<b>A. Traffic noise along the Charampa</b>				
1	At Raliway Station	16	86.1	129
2	UBI Bank	16	79.3	109.2
3	At High School road	16	82.3	117.3
4	Near Petrol Pump	16	76.4	114.5
<b>B. Traffic noise along the Bypass <i>Chhak</i> (Square)</b>				
1	Near Jagannath temple	16	73.1	105.5
2	Near Taxi stand	16	81.5	118.6
3	At Pirdos hotel	16	78.2	113.1
4	In front of TV show room	16	75.4	108.9
<b>C. Traffic noise along the Naya Bazar</b>				
1	Near Hospital	16	83.4	114.7
2	In front of Nokia Show room	16	77.5	112.3
3	In front of Cinema hall	16	85.4	110.4
4	In front of Medicine Store	16	89.7	109.4
<b>D. Traffic noise along the College <i>Chhak</i></b>				
1	Near Vegetable market	16	87.5	115.7
2	In front of Post office	16	83.4	118.7
3	Near Loknath temple	16	74.7	101.5
4	At Stationary shop	16	76.7	107.3
<b>E. Traffic noise along the Kacheri Bazaar</b>				
1	At Bus stand	16	90.3	128
2	Near Jewelers shop	16	85.5	113.4
3	At Hotel Orion	16	87.2	120.3
4	Near Sweet shop	16	78.7	109.1

**Table 4: Episodic and impulsive noise levels (20 observations) by the air-horn of motor vehicles in Bhadrak**

Vehicle type	Minimum Sound Pressure levels in dB (A)	Maximum Sound Pressure levels in dB (A)
Truck	103.2	123.4
Bus	101.2	118.3
Bolero	96.8	115.5
Trekker	98.3	113.2
Motor cycle	92.5	110.2
Tractor	106.4	116.5
Dumper	101.2	119.6
Tempo	95.5	114.7



assessments of the sound environment should not be based exclusively on acoustically measurable data, but should include the analysis and correlation of different other parameters. Soundscapes of Bhadrak are affected by a number of factors such as environmental and urban zoning, main traffic routes, residential streets, vegetation, types of public transportation and types of shopping complex. Analysis and study of these factors can serve as an important tool to define a green urban project and would certainly promote a greater sense of acoustic comfort.

A total of 256 individuals of Bhadrak area were interviewed for perception of soundscape of the study area. This survey clearly demonstrates that most of the people including vehicle drivers, students and vendors were aware of noise pollution. However, the interviewees indicated that issues relating to noise pollution take a back seat compared to their concerns for water pollution; solid waste pollution and social problems. Nevertheless, 81% respondents were not satisfied about the noise level in their places in Bhadrak. They described themselves as being personally affected by noise pollution. 51% of the respondents described road traffic noise as the most irritating noise that they would like to get rid of. It is observed that most of the respondents are highly annoyed by different types of vehicular source, especially of motor cycle whose numbers are increasing in an upsetting rate.

Most of respondents told that they have had at least one experience of being temporarily 'deafened' by a loud noise. This sort of partial hearing loss is called Temporary Threshold Shift (TTS). If anybody suffers frequently TTS, he may suffer complete hearing loss. Headache, bad temper, hearing problem, loss of concentration were some of the significant effects manifested by noise pollution (Goswami, 2009). 39% respondents identified headache as the main health effect of noise pollution and 21% respondents have visited ENT specialist doctors for treatment of health problems. 72% of students reported that their study was disrupted by frequent air horns of vehicles. 15% of people shared their sleep disturbance due to traffic noise during night-time. It warrants a systematic survey of sleep quality, number of awakenings or number of changes in sleep state to estimate the extent of sleep disturbance.

People from all sections of the society support the ban of hydraulic horn, improved traffic control, banning of very old vehicles, banning of high-noise creating industries, zoning town areas according to their noise ranges and banning of usage of sound amplifying mikes for processions, advertising and election campaigns. The

individual can also control noise from his own vehicle by adequate maintenance, by fitting a suitable silencer and even by using noise as a criterion when purchasing the vehicle. It is also worth mentioning that from the noise point of view, it is better to concentrate traffic along main roads (that are already noisy) then to distribute between parallel roads. Noise from the majority of roads can also be controlled by local pressure groups, but the process is long and requires perseverance and is not easy when the road already exists. If someone really does find traffic noise intolerable, solution is double glazing on windows facing the road, which will reduce the level by up to 20 dB (A) (Pancholy et al., 1967; Griffiths and Langdon, 1968; Robinson, 1971; Prabhu and Chakraborty, 1978; Peterson, 1980; Roy et al., 1984; Rao et al., 1987; Ravindranath et al., 1989; Pamanikabud and Chairsi, 1999; Katyal and Satake, 2001; Pandya and Dharmadhikari, 2002; Agrawal, 2002; Nirjar et al., 2003; Kumar et al., 2004; Dash, 2004; Yusoff and Ishak, 2005; Thakur, 2006; Gorai and Pal, 2006; Das, 2006). This is an appreciable degree of quietening, but is by no means silence.

Hence increasing general awareness, adopting better technologies, strictly promulgating laws and after changing some of our practices, we can control noise pollution. The laws should be implemented properly to reduce the unwanted noise. Then we can hope for a better world to live in. Therefore, Bhadrak District Administration, Bhadrak Police Station and Bhadrak Tahasil and Block Administration should take some imperative steps and regulatory measures to abate such noise pollution. The authorities should remember that noise is not a measure of the progress of technology; but it is a sign of regress.

### Acknowledgements

Author is thankful to Sri Devdas Chotray, Vice Chancellor, Ravenshaw University, Cuttack for providing him necessary research facilities.

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