

## **A Preliminary Study on Assessment of Noise Levels in Indian Offices: A Case Study**

**Bijay Kumar Swain, Shreerup Goswami<sup>1\*</sup> and Madhumita Das<sup>2</sup>**

Department of Botany (Environmental Science), Utkal University, Vani Vihar, Bhubaneswar – 751004

<sup>1</sup>Department of Geology, Ravenshaw University, Cuttack – 753003

<sup>2</sup>Department of Geology, Utkal University, Vani Vihar, Bhubaneswar – 751004, Odisha

✉ goswamishreerup@gmail.com

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**Abstract:** The urban noise pollution is growing day by day and has become a universal problem for both the public and the policy-makers. The increase in number of market complexes, growing population and consequently increase in number of vehicles have inevitably caused major noise pollution in different public places and government offices. Now-a-days, there are records of high level of dissatisfaction due to noise incidence in and around different offices. Therefore, an attempt has been made to assess the noise pollution levels at 10 different office corridors in and around the city of Balasore. The noise data collected from different offices displayed wide ranges of noise level varying in three different times (10-12 noon, 1-3 pm and 3-5 pm). The maximum noise level was assessed at RTO office (83.4 dB), while minimum was assessed at Head Post Office (43.7 dB). Also, the maximum equivalent noise level was assessed at RTO office (75.3), while minimum was assessed at Income Tax office (58.3). The maximum noise pollution level (NPL) and Noise Climate (NC) were assessed at RTO office (96.6) and Collectorate office (26.5) and minimum was assessed at Inspector of Schools (70.4) and at Horticulture office (11.2) respectively.

**Key words:** Office corridors, office noise, noise pollution level, Balasore.

### **Introduction**

Urban noise disturbance has detrimental effect on the tranquility of the area. Noise pollution is an air-pollutant, which possesses a number of auditory and non-auditory effects on the exposed inhabitants. The effects of noise pollution are noise-induced hearing impairment; interference with speech communication; disturbance of rest and sleep; psycho-physiological, mental-health and performance effects; effects on residential behaviour and annoyance; cognitive performances and interference with intended activities (WHO, 1999; Gorai and Pal, 2006; Babisch, 2005). The studies on traffic noise, highway noise, noise in banks and soundscapes of different cities of the Indian cities have been worked out since last few decades (Chakraborty et al., 2002;

Goswami and Swain, 2012 a, b; Swain et al., 2012 a, b, 2013; Swain and Goswami, 2012, 2013a, b, 2014). The increase in number of market complexes, growing population and consequently increase in number of vehicles have inevitably caused major noise pollution problems. Now-a-days, there are records of high level of dissatisfaction due to noise incidence in and around different offices. Therefore, an attempt has been made to highlight the noise pollution levels at 10 different office corridors in and around Balasore town.

### **Materials and Method**

The Balasore city is located at 21° 06' North Latitude and 86° 50' East Longitude in the state of Odisha. The noise levels were measured following standard

\*Corresponding Author

procedure using calibrated sound level (dB) meter (Model LUTREN, SL-4010) on 13<sup>th</sup> February, 2012 to 18<sup>th</sup> February, 2012 (for five days) at outside of the 10 different offices (Collectorate office, Sadar Tahasil office, Inspector of Schools office, District Project Co-ordinator office, Head Post Office, Horticulture office, Block Development office, Municipality office, RTO office and Income Tax office) of Balasore (Nirjar et al., 2003; Goswami, 2011; Goswami and Swain, 2011; 2013; Goswami et al., 2011; Mohapatra and Goswami, 2012 a, b; Pradhan et al., 2012 a, b). By using sound level meter, noise levels are measured during three different specified time intervals (10-12 noon, 1-3 pm and 3-5 pm).

Noise descriptors such as Leq, NPL (Noise Pollution Level) and NC (Noise climate) were assessed to reveal the extent of noise pollution at 10 specified government offices of Balasore town. Noise descriptors such as  $L_{10}$ ,  $L_{50}$  and  $L_{90}$  were also assessed to calculate the value of  $L_{eq}$  using the following formula of Robinson (1971).

$$L_{eq} = L_{50} + (L_{10} - L_{90})^2/56,$$

where  $L_{10}$  is the level that exceeded during 10% of the measuring time in dB(A),  $L_{50}$ —the level that exceeded during 50% of the measuring time in dB(A), and  $L_{90}$  is the level that exceeded during 90% of the measuring time in dB(A).

Noise Pollution Level (NPL) expressed in dB was calculated by using the formula  $[NPL = L_{eq} + a (L_{10} - L_{90})]$ , where,  $a = 1.0$  (constant in the equation). Noise Climate (NC) is the range over which the sound levels are fluctuating in an interval of time. NC was assessed using the formula  $(NC = L_{10} - L_{90})$ .

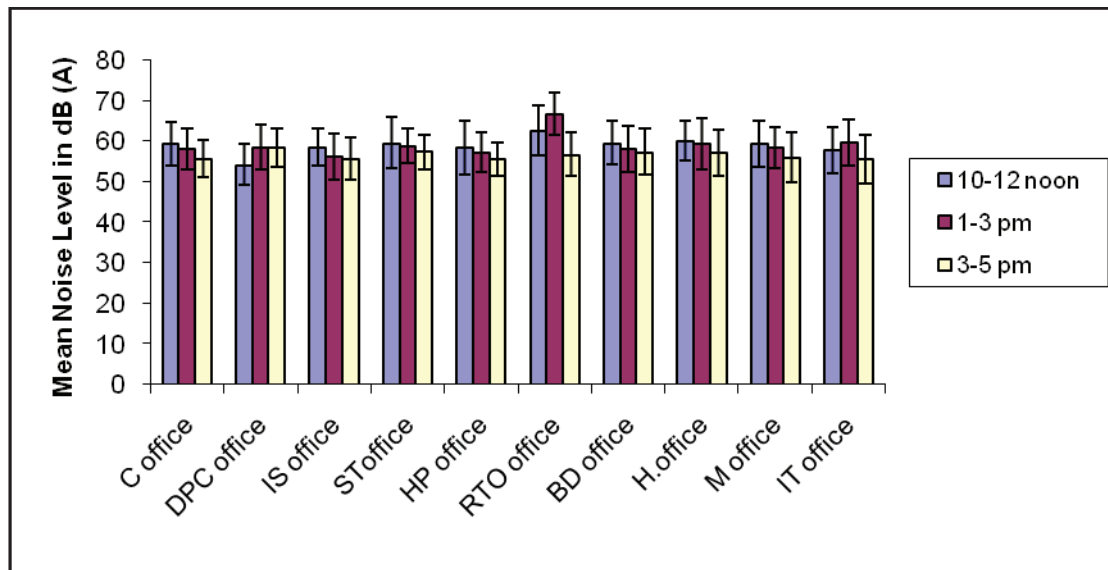
## Results and Discussion

Noise pollution was assessed and analyzed in 10 specified offices of Balasore (Table 1). It was observed that peak levels of activity occur in the offices in the forenoon i.e. during 10-12 noon. There are fairly less noise during 1-3 pm and 3-5 pm. While conducting noise survey, it was observed that main sources of noise in the investigated offices were generators, fans, printers, rush at parking places and chattering among the (office) employees or the people coming to the respective office for their official work. The noise data collected from different offices displayed wide ranges of noise level varying in aforesaid three different times (10-12 noon, 1-3 pm and 3-5 pm). The noise levels of 10 specified offices were calculated and presented in Table 1. The maximum noise level was assessed at RTO office (83.4 dB), while minimum was assessed at Head Post office (43.7 dB). The mean noise level along with standard deviations was calculated and presented in Figure 1.

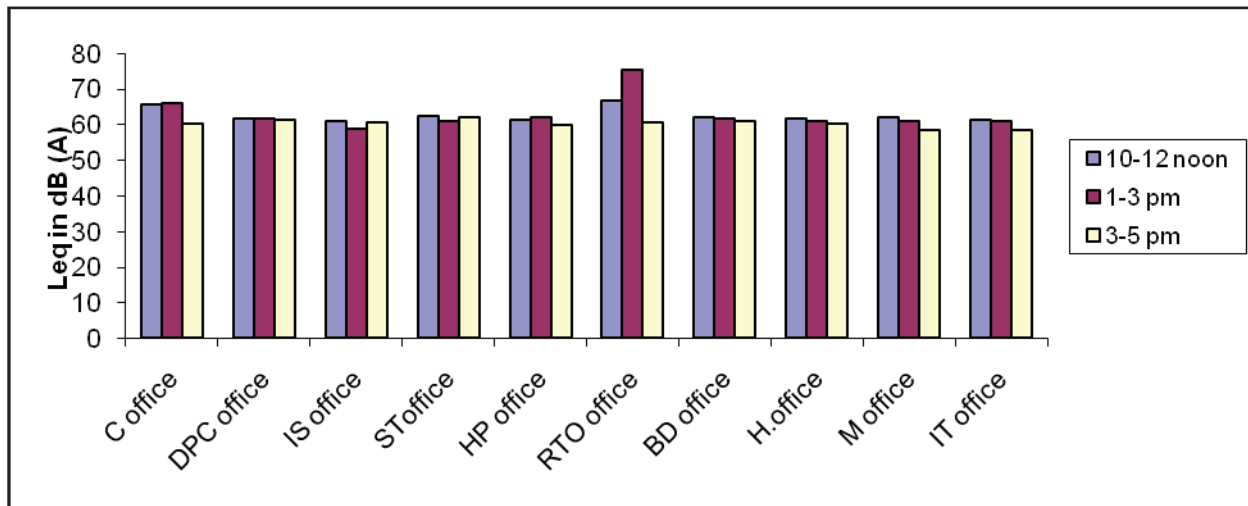
All these offices are located in the heart of this city and along the main road. Thus, the noise from road traffic was also major contributor to these offices. In all the cases, the minimum noise levels are within the permissible limit (50 dB). Noise descriptors such as  $L_{10}$ ,  $L_{50}$  and  $L_{90}$  (Table 1) were also assessed to calculate the value of  $L_{eq}$  by using the formula:  $L_{eq} = L_{50} + (L_{10} - L_{90})^2/56$ , and presented in Figure 2. It reveals that maximum equivalent noise level was assessed at RTO office (75.3), while minimum was assessed at Income Tax Office (58.3). In all the cases the equivalent noise levels are beyond the permissible limit (50 dB) (WHO, 1999).

**Table 1: Noise level (dB) variations of different offices of Balasore city at three specified time intervals**

Name of the offices	10-12 Noon					1 - 3 pm					3-5 pm				
	Min	Max	$L_{10}$	$L_{50}$	$L_{90}$	Min	Max	$L_{10}$	$L_{50}$	$L_{90}$	Min	Max	$L_{10}$	$L_{50}$	$L_{90}$
Collectorate office	45.2	76.1	72.3	58.5	52.5	46.1	78.2	73.3	57.6	51.8	47.3	73.6	66.8	55.5	50.4
District Project Co-ordinator office	46.8	73.5	68.4	57.8	53.5	49.9	77.8	68.5	57.3	52.7	44.6	72.6	64.5	56.4	48.3
Inspector of Schools office	47.3	73.9	66.5	57.6	53.1	46.6	77.6	64.8	56.5	53.3	45.8	77.4	66.2	55.6	49.7
Sadar Tahasil office	45.6	75.2	67.8	58.5	52.7	47.3	78.5	67.7	56.8	52.4	44.6	77.3	67.9	56.2	50.1
Head Post Office	45.4	72.6	67.5	57.1	51.9	47.1	76.1	68.1	56.9	51.3	43.7	75.9	66.2	54.8	49.6
RTO office	48.3	81.6	70.5	62.3	54.6	46.6	83.4	74.1	67.2	52.8	46.8	76.5	67.3	54.8	49.4
Block Development office	44.6	74.7	68.1	57.7	52.6	45.8	78.7	67.4	57.3	51.6	48.2	76.9	68.2	56.4	52.3
Horticulture office	48.1	77.3	65.4	59.4	54.2	45.6	81.6	65.1	58.4	53.5	48.4	78.1	67.3	55.8	51.6
Municipality	45.4	78.4	67.3	58.6	53.6	47.2	80.8	66.5	57.6	53.1	47.7	75.2	64.6	55.3	51.2
Income Tax office	46.1	77.6	66.5	57.7	52.8	47.2	82.3	65.8	58.1	53.3	45.4	74.3	65.1	54.6	50.8



**Figure 1: Mean noise level of 10 different offices of Balasore during three specified times; where C office – Collectorate office, DPC office – District Project Coordinator office, IS office – Inspector of Schools office, ST office – Sadar Tahsil office, HP office – Head Post Office, RTO office – Road Transport office, BD office – Block Development office, H office – Horticulture office, M office – Municipality office and IT office – Income Tax office.**

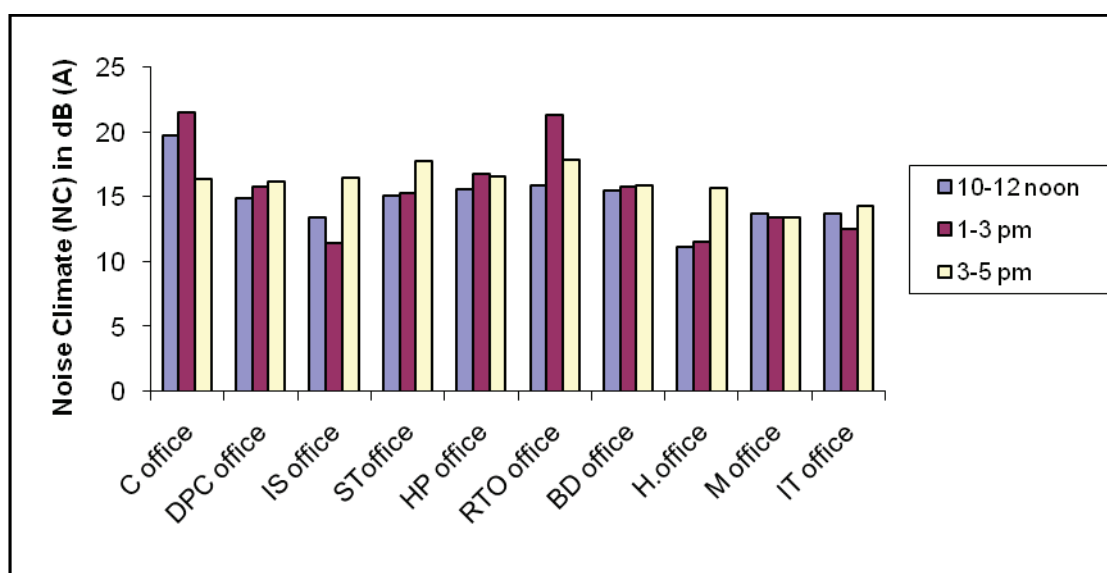


**Figure 2: Equivalent noise ( $L_{eq}$ ) level of 10 different offices of Balasore during three specified times; where C office – Collectorate office, DPC office – District Project Coordinator office, IS office – Inspector of Schools office, ST office – Sadar Tahsil office, HP office - Head Post Office, RTO office – Road Transport office, BD office – Block Development office, H office – Horticulture office, M office – Municipality office and IT office – Income Tax office.**

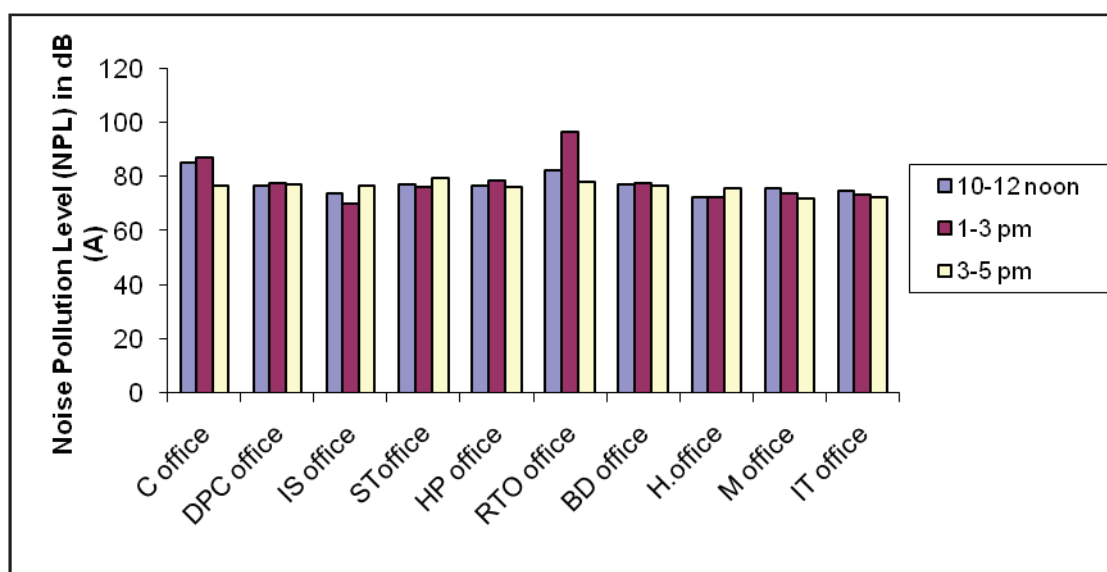
Noise Climate (NC) is the range over which the sound levels are fluctuating in an interval of time and was assessed using the formula ( $NC = L_{10} - L_{90}$ ) and presented in Figure 3. This figure illustrates that maximum NC value was assessed at Collectorate office (26.5), while minimum was at Horticulture office (11.2). NPL takes into account the variations in the sound signal and hence serves as better indicator of the pollution in

the environment for physiological and psychological disturbance of the human system. The Noise Pollution Level (NPL) was assessed and presented in Figure 4. The figure clearly depicts that the maximum NPL was found at RTO office (96.6), while minimum was at Inspector of Schools (70.4).

It is evident that headache, bad temper, hearing problem, loss of concentration during working hours



**Figure 3: Noise Climate (NC) of 10 different offices of Balasore during three specified times; where C office – Collectorate office, DPC office – District Project Coordinator office, IS office – Inspector of Schools office, ST office – Sadar Tahsil office, HP office – Head Post Office; RTO office – Road Transport office, BD office – Block Development office, H office – Horticulture office, M office – Municipality office and IT office – Income Tax office.**



**Figure 4: Noise Pollution Level (NPL) of 10 different offices of Balasore during three specified times; where C office – Collectorate office, DPC office – District Project Coordinator office, IS office – Inspector of Schools office, ST office – Sadar Tahsil office, HP office – Head Post Office, RTO office – Road Transport office, BD office – Block Development office, H office – Horticulture office, M office – Municipality office and IT office – Income Tax office.**

were some of the significant effects manifested by noise pollution (Banerjee and Chakraborty, 2006; Goswami, 2009; Jakovljevic et al., 2009; Goswami et al., 2013 a, b). It warrants a systematic survey of annoyance to estimate the extent of disturbance in the work of office

employees. One of the most annoying aspects of noise is that it interferes with speech. In the presence of background noise, one has to raise the voice to carry out conversation and this contributes to further noise pollution.

## Conclusion

The present study clearly demonstrates that usually most of the employees and people speak in a louder voice due to speech interference, which irritates them and reduces their work efficiency (Kudesia and Tiwari, 2007; Bluhm et al., 2004; Diniz and Zannin, 2004). Among three sampling times, highest noise levels were recorded during 10-12 noon (forenoon) in all the 10 investigated offices. Hence increasing general awareness and after changing some of our practices, we can be able to control noise pollution in the offices and public places.

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