

Determination of Noise Level of Different Places of Rajshahi City

M. N. BARI¹, A. BISWAS², A. A. BAKI²

¹Department of Civil Engineering, RUET, Bangladesh (niamulbari@gmail.com)

²Undergraduate Student, Department of Civil Engineering, RUET, Bangladesh

Abstract

Noise level of different cities exceeds the acceptable level and creates annoyances. It is not simply an annoyance rather a hazard to one's physical and mental well-being. Along with the increasing degree of air and water pollution, noise pollution is also emerging day by day. Motorized traffic is one of the major sources of producing noise in urban areas. The present paper deals with determining of traffic induced noise pollution at different places of Rajshahi city of Bangladesh. In this study noise levels have been measured with digital sound level meter at ten different places of Rajshahi city from 8:00 am to 8:00 pm during two working days and one holiday. The data have been analyzed to calculate the average, maximum and minimum noise level in decibel (dB) with respect to traffic volume. It is observed that at all the locations, the level of noise remains far above the acceptable limit for all the time. The more acute zone among the 10 selected places was determined at the Kadirganj where the maximum noise level was 107.3 dB. The lowest average level of noise (52.3 dB) was observed at Laxmipur bypass. The maximum decibel of noise at Kajla, Chistia Mess gate, Hadir More, Barendra Museum More, Sagarpara Bat-Tala More, Medical Banda gate, Laxmipur bypass, New Government Degree College gate and Court were 103.4 dB, 105.8 dB, 103.3 dB, 101.6 dB, 99.9 dB, 102.3 dB, 104.7 dB, 98.7 dB and 95 dB respectively.

Keywords: *Noise, Traffic Volume, Pollution.*

1 Introduction

The word noise comes from the Latin word nausea meaning sea sickness. The general meaning of 'NOISE' is an over loud or disturbing sound, which breaks the calmness of the atmosphere (Shahid and Bashir, 2013). When the level increases to an irritable level, it can be considered as "noise pollution" in the atmosphere (Philimoni, et al., 2011; Stanchina and Hijlem, 2005; Crmiel, et al., 2004). Noise is one the major environmental hazards of modern world originating from a wide variety of sources, including traffic (air, road, rail), industrial facilities, or social activities. Nowadays developing countries are experiencing noise pollution. In the subject of protection the public health and welfare, the noise has negative effects on the environment and the people. It is the less obvious but rather a problem that has grown steadily worse with time.

Industrial development through imported technology and the concentration of small locally based industries in the developing countries, have led to the introduction of uncontrolled and unknown wastes into the environment in liquid, solid and gaseous forms. Besides such obvious forms of pollution, there are also the insidious forms, such as noise pollution (Moela, 2010).

In World Health Organization (WHO, 2005) statements, "large city noise is considered to be the third most hazardous pollution". The WHO declared, "Worldwide, noise-induced hearing impairment is the most prevalent irreversible occupational hazard, and it is estimated that 120 million people worldwide have disabling hearing difficulties. The WHO has also established maximum allowable levels of noise, above which people are harmed; it is widely known that in many parts of Bangladesh, those levels are regularly exceeded. Regular exposure to high levels of noise damages hearing. Noise pollution can also increase stress and blood pressure, cause troubles sleeping and concentrating, and lead to bad tempers and fights. It is reported that the hearing ability of the inhabitants of the City has reduced during the last ten years (Ahmed, 1998). About five to seven percent of the patients admitted to the Bangabandhu Sheikh Mujibur Rahman Medical University, Dhaka are suffering from permanent deafness due to noise pollution (Ahmed, 1998). The survey regarding noise pollution was performed

by Geography & Environment department of Jahangirnagar University. 100 people were interviewed among different professionals like doctor, traffic police, driver, teacher, student, businessman and service holders. The number of people suffering from deafness as a consequence of noise pollution is increasing. The major sources of noise are industrial noise, community noise and traffic noise. Out these, the traffic noise is the most one. The major factors which, influence the generation of road traffic noise are traffic flow, traffic speed, proportion of heavy vehicles, gradient of the road and nature of the road surface. Mainly traffic noise depends on the vehicle noise. This phenomenon caused by vehicular congestion and it affects the people who work outdoors, for example the rickshaw-pullers, street vendors, small shopkeepers etc. Some regulation regarding use of horns, particularly banning hydraulic horns and raising public awareness against the habit of honking may can help in solving this situation to a large extent.

Bangladesh is a developing country. Rajshahi (historically Rampur Boalia; nicknamed "Silk City") is a metropolitan city in Bangladesh, major urban and industrial centre of North Bengal and the seat for administrative headquarters of Rajshahi District and Rajshahi Division. It has a population of over 800,000 people (wikipedia). Rajshahi is located on the north bank of the Padma River, near the Bangladesh-India border. With the increasing of population, the number of vehicle is increasing in the city day by day. As a result sound pollution in the city is created by the traffic vehicle. Therefore, the aim of this study is to identify the acute zone in terms of noise level in Rajshahi city that will be helpful for the planner and decision maker to take necessary measures.

2 Methodologies

The sound level data were collected at different points which were selected according to the importance and vulnerability. The noise measurements were carried out at 10 locations of Kajla gate, Chistia Mess gate, Kadirganj, Medical Banda gate, Laxmipur bypass, Sagarpara Bat-Tala, Hadir More, Barendra Museum More, New Govt. Degree College gate and Court. The study points are selected at running portion of the road to find out the noise level at the place other than road intersection that was studied earlier and published elsewhere (Bari, et al., 2016). The data collection was conducted for three days along with a holy day for each point from 8:00 am to 8:00 pm. Data were collected at every 15 minutes by the Digital Sound Level Meter (from 30 dB to 130 dB) in decibel unit. The numbers of vehicle were also counted. The recorded data was analyzed for average maximum and minimum noise level with standard deviation and showed the relationship between traffic volume and noise level graphically.

Traffic volume was calculated in passenger car unit for 15 minutes from the collected data by using following equation:

$$\text{Traffic volume} = 3 \times (\text{number of buses} + \text{number of trucks}) + 1 \times (\text{number of cars} + \text{number of power trailers}) + 0.75 \times (\text{number of easy bike}) \quad (\text{pcu}/15\text{min}) \quad (1)$$

Average traffic volume and standard deviation of traffic volume was also calculated. Average traffic volume, average maximum and minimum noise levels in decibel were plotted in normal graph paper with respect to time.

3 Results

Average values of maximum and minimum noise level in decibel for three days are determined for each study points. Three days traffic survey data are converted in passenger car unit (15 min) and average values are determined (in pcu/15min). The results of average noise levels for selected ten locations are plotted with respect to time in Figure 1.

Kajla is an entry point of Rajshahi city and busy traffic area. According to Department of Environment (DoE), the maximum acceptable noise level in busy traffic area is 85 dB. Figure 1 shows that all the values of average maximum noise level are higher than the acceptable limit at Kajla. The highest value of average maximum noise level is 103.4 dB. Chistia Mess gate is a mixed type area and most of the values of average maximum noise levels are higher than 60 dB, which are more than the acceptable limit for this place. The highest value of average maximum noise level is 105.8 dB. The average minimum noise level is also going above the limit for most of the time. Kadirganj is both a commercial and busy traffic area in Rajshahi city and the maximum acceptable noise level is 85 dB. Most of the time, the average maximum noise levels are above 100 dB and average minimum noise levels are above 60 dB which are also not satisfactory. The average highest maximum noise level is found to be of 107.3 dB which is more acute than the acceptable value. The lowest average minimum noise level is found to be of 60.9 dB.

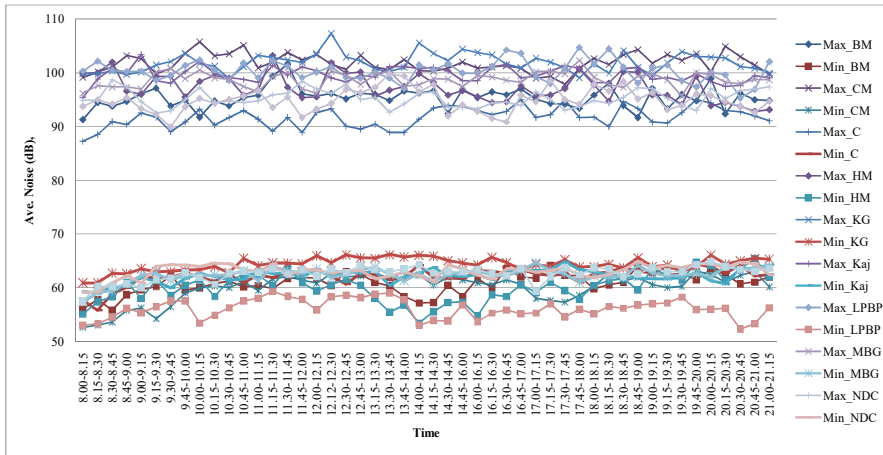


Figure 1. Average maximum and minimum noise level with respect to time (BM-Barendra museum, CM-Chistia mesh, C-Court, HM-Hadir more, KG-Kadirganj, Kaj_Kajla, LPBP-Laxmipure bypass, MBG-Medical bandha gate, NDC-New govt. college, SP-Sagarpara)

Laxmipur bypass is a busy traffic area where also the average maximum noise levels exceeds allowable limit. The highest average maximum and lowest average minimum noise level is found to be of 104.7 dB and 52.3 dB, respectively. Court area is a mixed type area where administrative, educational, commercial and residential establishments are situated. Heavy motorized commercial vehicles passing through this point comparatively in small quantity. Hence, traffic density is very low here. Figure 1 shows that average maximum noise levels are ranging between 85 dB to 95 dB. After 9:00 am the average minimum noise levels are above 60 dB which are not satisfactory. The average highest maximum noise level is found to be of 95 dB. Hadir More is a busy traffic area. Figure 1 shows that most of the values of average maximum noise level are lower than 100 dB, but higher than 85 dB. All the values are more than the acceptable limit. The highest value of average maximum noise of 103.3 dB is found at this location. The road in front of Barendra Museum is a busy traffic area. The average maximum noise limits varies ranging between 90 dB to 100 dB. All the values are more than the acceptable limit. The highest value of average maximum noise is found here of 101.6 dB. The minimum noise level is also not satisfactory.

Sagarpara is a residential area and the maximum acceptable noise level in residential area is 45-50 dB. Sometimes, buses and trucks are running through this road. The study shows that all the values of average maximum noise limits are ranging between 90 dB to 100 dB. All the values are more than the acceptable limit. The highest average maximum noise level is found here 99.9 dB. In the cases, the average minimum noise level is also not satisfactory. Medical Banda gate and New Govt. Degree College are mixed type areas and the maximum acceptable noise level in mixed area is 60 dB. The average maximum noise levels are higher than that of standard limit and the average minimum noise level is also not satisfactory. The highest value of average maximum noise level is found here of 102.3 dB at Medical Banda gate. While, the average maximum noise levels are ranging between 90 dB to 100 dB and after 9:00 am the average minimum noise levels are above 60 dB at New Govt. Degree College. The average highest maximum noise level is found to be of 98.7 dB.

The relationships between traffic volume and noise levels at every location are presented in Figure 2. The figure depicts that the traffic volume is increasing from 9 am and higher traffic volume was found to be between 9 am to 4 pm with some fluctuations. The average highest traffic volume of 225 was recorded in front of Chistia Mess at 1-15 pm and the lowest traffic volume was 40 at in front of court. According to traffic volume, the study points can be categorized as extreme traffic intensive point (above 160 pcu/15 min), medium traffic intensive point (100-160 pcu/15 min), ordinary traffic intensive point (80-100 pcu/15 min) and low traffic intensive point (below 80 pcu/15 min). As per these classifications, Chistia mess, Kajla and Kadirganj are falling in extreme traffic intensive point; Hadir more, Medical bandha gate and Baredra museum are falling in medium traffic intensive point; Laxmipur bypass and New degree college are falling in ordinary traffic intensive point while

Sagarpara and Court area are falling in low traffic intensive point. It is observed from figure that the maximum noise level does not depend on traffic volume rather traffic horn and crowd.

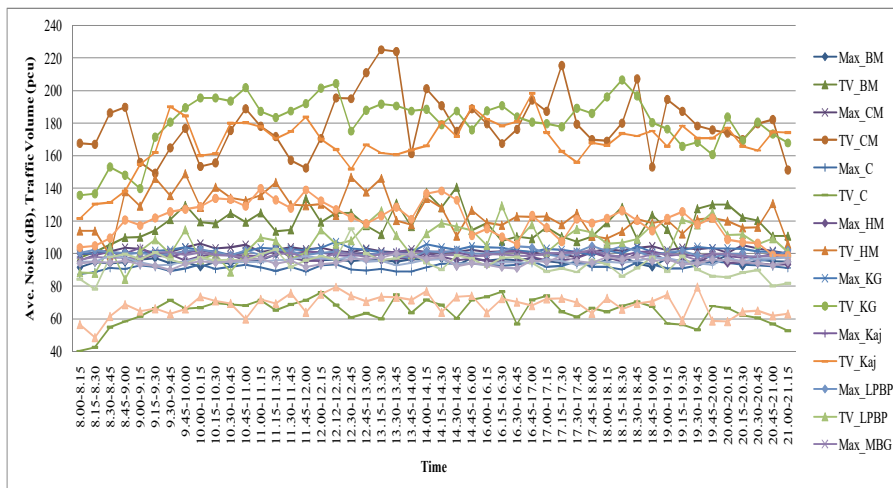


Figure 2. Average maximum noise level and average traffic volume with respect to time (BM-Barendra museum, CM-Chistia mesh, C-Court, HM-Hadir more, KG-Kadirganj, Kaj_Kajla, LPBP-Laxmipure bypass, MBG-Medical bandha gate, NDC-New govt. college, SP-Sagarpara)

4 Discussions

Maximum locations are mixed type commercial and residential in nature among the selected points. From this study it was found that the heavy motorized commercial vehicles such as bus, truck pass through the Kajla, Chistia Mess gate, Kadirganj, Medical Banda gate and Laxipur bypass intensively. On the other hand commercial vehicles pass comparatively in small quantity through the Sagarpara, Hadir More, Barendra museum More, New Govt. Degree College gate and Court. The highest average level of sound (107.3dBA) was observed at Kadirganj and lowest average level of noise (52.3 dBA) was observed at Laxipur bypass. The maximum decibel of noise at Kajla, Chistia Mess gate, Hadir More, Barendra Museum More, Sagarpara Bat-Tala More, Medical Banda gate, Laxipur bypass, New Govt. Degree College gate and Court were 103.4 dB, 105.8 dB, 103.3 dB, 101.6 dB, 99.9 dB, 102.3 dB, 104.7 dB, 98.7 dB and 95 dB, respectively. The average maximum and minimum noise level recorded for each location is shown in Figure 3 and 4. The pollution levels for each location are presented in Table 1.

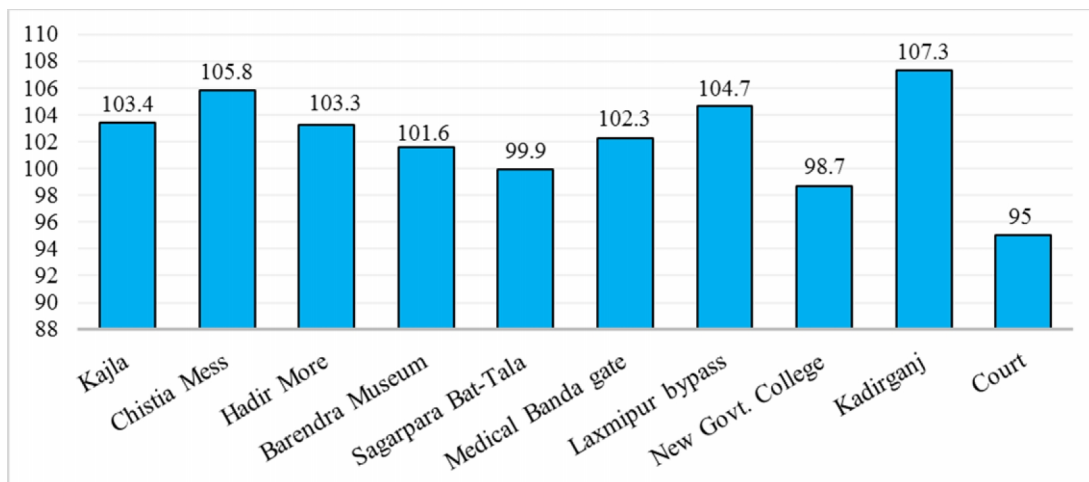


Figure 3. Average maximum noise level in decibel at different study points

Figure 3 depicted that the highest average maximum noise level was found at Kadirganj and no places had average maximum noise level within acceptable limit (85 dB) among 10 places.

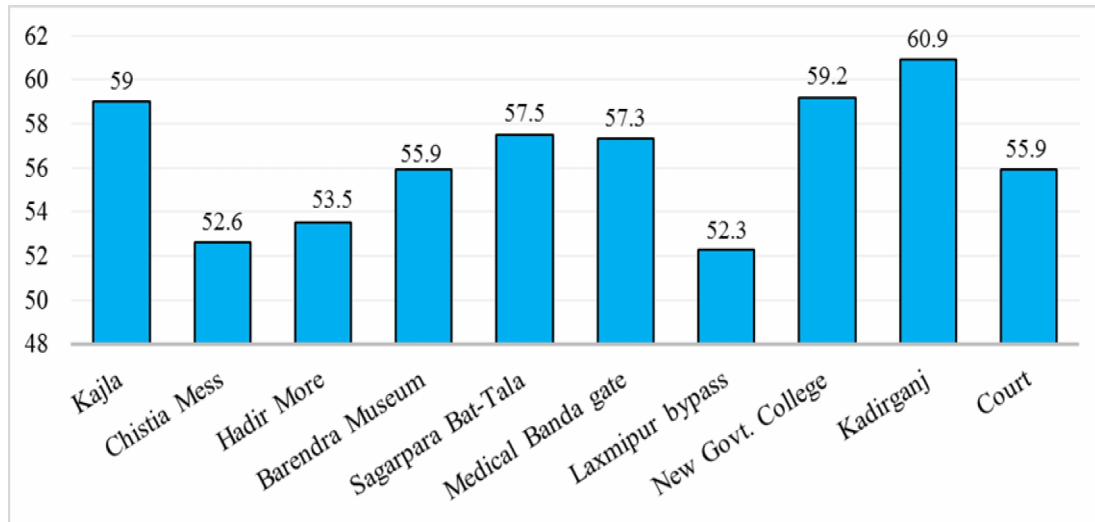


Figure 4. Average minimum noise level in decibel at different study points

Figure 4 shows that the lowest average minimum noise level was observed at Laxmipur bypass. The average minimum noise levels at all the selected places were above 50 dB which were not satisfactory.

Table 1. Average maximum and minimum noise in decibel

Location	Type of Area	Permissible noise limit (dB), DoE	Average maximum noise (dB)	Level of noise pollution	Average minimum noise (dB)
Kajla	Busy Traffic Area	85	103.4	18.4 ⁸	59
Chistia Mess gate	Mixed Area	60	105.8	45.8 ²	52.6
Hadir More	Busy Traffic Area	85	103.3	18.3 ⁹	53.5
Barendra Museum	Busy Traffic Area	85	101.6	16.6 ¹⁰	55.9
Sagarpara Bat-Tala	Residential Area	50	99.9	49.9 ¹	57.5
Medical Banda gate	Mixed Area	60	102.3	42.3 ³	57.3
Laxmipur bypass	Busy Traffic Area	85	104.7	19.7 ⁷	52.3
New Govt. Degree College gate	Mixed Area	60	98.7	38.7 ⁴	59.2
Kadirganj	Busy Traffic Area	85	107.3	22.3 ⁶	60.9
Court area	Mixed Area	60	95	35 ⁵	55.9

Table 1 shows that the highest noise induced pollution is at Sagarpara Bat-Tala followed by Chistia Mess gate, Medical Banda gate, New Govt. Degree College gate, Court area, Kadirganj, Laxmipur bypass, Kajla, Hadir More and Barendra Museum. Among the study areas, Sagarpara Bat-Tala, Chistia Mess gate, Medical Banda gate, New Govt. Degree College gate and Court area are considered to be the most acute zones for noise pollution.

According to Indian standard for heavy vehicle the maximum decibel is 91dB. But in all the cases, the maximum noise levels are much higher than that of standard limit and the minimum noise level is also not satisfactory in Rajshahi city. About 52% points had maximum noise level greater than 80 dB, 20% points had around 71-80 dB and 27% points had around 61-70 dB for working day in the Dhaka city (Ayaz and Rahman, 2011). Noise levels at maximum places of Dhaka city were fluctuating in and around the permissible limits accepted by DoE. Chittagong was environmentally polluted with noise continuously and the ranges of noise levels were 75.29 to 90.12 dB which exceeded the maximum allowable limit (Muhit and Chowdhury, 2013). Noise level in Sylhet City near the vulnerable industry, CNG refueling stations and Kumargaon PDB were much higher than the acceptable limit (Chakraborty, et al., 2013). The condition of noise level in Khulna city was also not

satisfactory. According to the World Health Organization (WHO), generally 60 dB sounds can make a man deaf temporarily and 100 dB sounds can cause complete deafness. But the noise level has been estimated at different points within ranges from 95 dB to 107.3 dB. According to the Department of Environment (DoE), the maximum acceptable noise level at the commercial area is 50-60 dB, at the residential area is 45 dB to 50 dB, at the busy traffic area is 85 dB, at the sensitive area is 45-55 dB and at the mixed area is 60 dB. Kadirganj and Kajla are the commercial and busy traffic areas of Rajshahi city. As a result, the maximum noise level in this area was higher than the acceptable limit. Sagarpara is mainly the residential area and Court is the mixed area. But the noise level at Sagarpara Bat-Tala More and Court were above the acceptable limit. It was found that noise level increased after 9:00 am, as it was the beginning of office hours. Huge number of people goes to office in the morning by many kinds of vehicles that create noise. At the evening noise level also increased as traffic flow reaches a peak at that time. At noontime the traffic flow remains relatively lower than that of morning and evening.

5 Conclusions

The analysis regarding average maximum and minimum noise level with respect to acceptable limit showed that almost all the places were at alarming noise level. From this study Kadirganj, Chistia Mess gate and Laxipur bypass can be identify as most acute place as their noise level is about 105 dB or more and Kajla, Medical Banda gate, Hadir More and Barendra museum More are acute places as their noise level is more than 100 dB. Proper maintenance of vehicles should be implemented to control the level of noise pollution. It is also observed that noise levels of different study areas are not directly related to traffic volume. However, noise generation is due to the honking of vehicles and crowd. Therefore, special measures should be taken to combat noise pollution.

References

- Ahmed, M.F. (1998). A Study on Noise Pollution in Dhaka City. Department of Environment, Bangladesh.
- Ayaz, S.B. and Rahman, M.M. (2011). Assessment of Roadway Noise Level and Potential Mitigation Measures. Vol. 1, Issue 2, pp 47.
- Bari, M.N., Shahin, M., Olid, M.K.B. and Islam, M.J. (2016). Noise Level of Important Places of Rajshahi City. First Conference on Research for Sustainable Development (FCRSD2016), 12-13 April 2016, FCRSD2016-EN-007, Research Centre, Shahjalal University of Science & Technology (SUST), Sylhet-3114, Bangladesh.
- Chakraborty, M.R., Khan U.S., Samad M.A. and Amin M.N. (2005). Noise Level in Different Places of Dhaka Metropolitan City (DMC) and Noise-Induced Hearing Loss (NIHL) in Dhaka City Dwellers. Bangladesh Med. Res. Counc. Bull. Vol. No.31 (2), pp 68-74.
- Crmiel, C.A., Klarr D.M., Gasser L.M., Oliphant and Neveau A.J. (2004). Noise control: a nursing team approach to sleep promotion. J. Nurs. Vol. No. 104(2), pp 40-48.
- Moela R.D. (2010). The impact of traffic noise pollution on the population of strubensavalley in roodepoort. Department of geography, environmental management and energy studies, University of Johannesburg. pp 1.
- Muhit, B.T. and Chowdhury S. (2013). Magnitude and Impact Analysis of Road Traffic Noise Pollution at Port City Chittagong, Bangladesh. American Journal of Environmental Engineering. Vol. No. 3(3), pp 132-145.
- Philimoni, K.M., Stelyus, L. and Mkoma, M.A.A. (2011). Noise pollution on wards in Bunda district hospital in Lake Victoria zone, Tanzania. Int. J. Environ. Sci. Vol. No. 1(5), pp 1007-1015.
- Shahid, M.A.K. and Bashir, H. (2013). Psychological and physiological effects of noise pollution on the residents of major cities of Punjab, Pakistan. Peak Journal of Physical and Environmental Science Research Vol. No. 1(4), pp 41-50.
- Stanchina, M.L. and Hijlem, A. (2005). The influence of white noise on sleep in subjects exposed to ICU noise. J. Vol. No. Vol. No. 6(5), pp 423-428.
- WHO, 2005. United Nations Road Safety Collaboration: A Handbook of Partner Profiles. World Health Organization, Geneva, Switzerland.