

## “PARKS, SOUNDSCAPE AND URBAN SUSTAINABILITY: AN EMPIRICAL STUDY”

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### ABSTRACT

Like other countries of the world noise often reaches unhealthy level in Dhaka, the capital of Bangladesh. Experiences and research during recent years have shown that urban green structures in Dhaka are more than just “icing on the cake.” Typically, noise from cars, trains and planes can exceed 100 decibels, twice the level at which noise becomes troublesome. Presence of vegetation or living biomass in significant amount in urban area is reported as a means of reducing sound and air pollution since leaves of trees make a huge surface area for settling down of dust particles and absorption of noise. Sound attenuation by foliage, stems, and ground differ depending on several factors, which are studied at six different Parks of different locations of Dhaka city, both on working days and weekends. Reflection of sound energy is found to be the primary mechanism. In addition, the psychological effect of a plant barrier on perceived noise level is also studied. The loudness of noise transmitted through the trees and through a minimal fence barrier in the study area (Park) differs as per the depth of the trees, location of the park (how much noisy the surroundings are) and also in relation to the increase in the distance of the listener from the sound source. In this paper effort has been made to study the soundscape scenario of the parks of Dhaka city. The paper addresses the urban quality of life in terms of increasing noise levels and declining quality of public parks.

**KEYWORDS:** Soundscape, Park, Urban, Sustainability

### INTRODUCTION

Noise often reaches unhealthy levels in several times at different parts of Dhaka. Experiences and research during recent years have shown that urban green structures in Dhaka are quite inadequate. Typically, noise from cars, trains and planes can exceed 100 decibels, twice the level at which noise becomes troublesome. The health risk is high in such cases, as shown by research in developed countries. Presence of vegetation in significant amount in urban area is reported as a means of reducing sound and air pollution since leaves of trees make a huge surface area for settling down of dust particles and absorption of noise. Trees and vegetation can help to abate noise through transferring sound to other objects, altering the direction of sound, bouncing the sound back to its source, bending sound waves around an object, and mixing unwanted sound with more pleasing sounds. Trees and other vegetation in conjunction with land forms reduce highway noise by 6-15 decibels while trees in combination with solid barriers reduce noise by 5-8 decibels; by comparison, a typical masonry wall sound barrier reduces noise levels by 15 decibels. Especially advantageous to humans is the fact that plants absorb more high frequency noise than low, since higher frequency noises are most distressing to people (Miller 1997). Increasing number of trees and other vegetation in the parks as well as in the whole city can play an important role in attenuating noise through absorbing undesired sound energy. In US one research estimate suggested that 7db noise reduction was achieved for every 33m of forest while other reported field tests show apparent loudness reduced by 50% by the presence of wide belts of trees and soft ground.

Vegetation in a city is sometimes synonymous to presence of nature in the predominantly man made environment. Urban vegetation is an important point for sustainable development, environmental conservation and urban planning

process of a city (Tunay et al, 2007). The urban environment is characterized by an intense use of the available space, where the preservation of open green spaces is of special ecological importance (Roessner, 2001). In urban areas various processes are responsible for destruction of vegetation such as construction works of residences, commercial areas, shopping complex and infrastructure development. The presence of vegetation in Dhaka is diminishing fast. In many cases, the parks and playgrounds are encroached upon illegally by powerful people. On the other hand the poor rootless people occupy many parks. Many parks are infested with slums and unhygienic condition, which is created there by these people. The environment of the open spaces or parks in the city is also decreasing at an alarming rate. The forest department in the country seems to be counting the total forested area, which is around 8%-9% but should be about 25%. Only counting will not replenish the natural ecosystem, rather the forests should contain many types of plant species, especially indigenous ones so that animal species specifically dependent on certain plants can survive. Due to growing population, Bangladesh does not have enough scope to regain about 25% as forested area, so we have to choose the best kinds of trees for planting and ensure to retain the remaining little amount of green areas. While greening the urban area, whatever small effort is made as such, there is no consideration for indigenous species of plants. Many alien species are planted to the detriment of exiting ecology pattern and this is happening because of the mistakes in the selection process of the trees to be planted. A notable problem for such vegetation in the city is air pollution. Various toxic gases such as NOX, SOX have adverse effect on the vegetation. The particulate matters in thick layer of dust on the leaves beside the road reduce the sunlight incidence on the leaves, hence hinder photosynthesis.

The thought of urban forestry is new in Dhaka. As a developing country, city authorities are busy most of the time to give service facilities to the people rather than think about green resources. Most of the time different green institutions in the city and government deal with big urban greening program by tree plantation activities. There are no exact area wise statistics for the percentage of trees in the city and also no area wise planning for tree plantation. In 2002, Dhaka City Corporation (DCC) were able to plant only 29 thousand trees out of the targeted 45 thousand because of lack of empty space; whereas adequate open spaces are needed for the sustainable development of a city. In 2003, DCC has planned to plant six thousand trees to replace those that have been uprooted, and a further ten thousand in whatever empty space is available in Uttara and Mirpur area of Dhaka.

In Dhaka 33% inhabitants experience hearing problems from noise pollution. Due to rapid urbanization and high land value, the city dwellers are now a day's bound to stay in the streeted apartment houses with heavy (vehicular) noise. For recreational purpose and to get refreshed, the urbanites sometimes visit the parks. But the parks of Dhaka are becoming more and more noisy. The parks are supposed to be quite places, where people can escape from the noise and get refreshed. In this research effort has been made to identify whether the parks of Dhaka are really noisy and affecting the society.

According to Dhaka city structure plan 1995-2015, policy 10 &11 demands the augmenting of city's open space and securing the future open space although there have no specific policy which can support sustainable livelihood. Well-planned and well managed green areas are essential for environmentally sustainable high quality of life for Dhaka city dwellers. So it is important for the authorities like RAJUK and Dhaka City Corporation to rethink about these issues and take the necessary actions.

## **IMPACT OF NOISE ON THE URBANITES**

Noise is an important health issue that affects more than hearing. The scientific research committed in this sector demonstrates that health effects occur at noise levels below those that impair hearing. Some of these health effects include increased risk for cardiovascular disease, negative effects on sleep, communication, performance and behavior, reading and

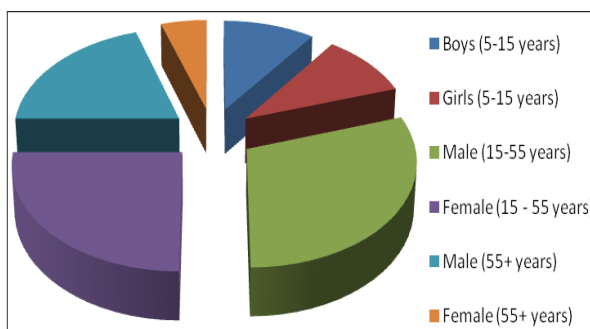
memory acquisition, and mental health. Controlling noise in Dhaka is a very difficult and complex undertaking that involves all levels of government as well as the private sector and the general public. Dhaka Public Health commission should be committed to increasing public awareness of the health effects of noise and encourage concerted action to reduce noise.

**SUSCEPTIBLE GROUPS**

There may be some populations at greater risk for the harmful effects of noise in any city. These groups include: the elderly, those with a mental health disorder (Thompson, 1996), the blind, possibly fetuses, and young children (Berglund & Lindvall, 1995). For example, children appear to be particularly susceptible to noise-induced health effects including: interference with speech acquisition and language development (which can create frustration and impair social interaction), inattention and impaired task performance, lower reading scores, and delayed motor reflex reactions (Westman & Walters, 1981). According to Berglund and Lindvall (1995), classrooms and day care facilities often surpass the recommended sound pressure level (e.g., 35 dB(A) during teaching sessions), compromising the optimum learning environment for children. For hearing impaired children, it is suggested that the sound level needs to be even lower. Youth and young adults appear to be at greater risk for noise-induced hearing loss due to their exposure to very high levels of noise during working hours (Axelsson, 1991). The Health Council of the Netherlands (1996) suggests that susceptible populations to the adverse health effects of noise can also include: people that are highly annoyed by low levels of road traffic noise (for hypertension); men exposed to high levels of road traffic noise at home as well as occupational noise (for ischaemic heart disease); and pregnant women who are exposed to occupational noise (for hypertension). Further, people with sleep disturbances have an increased risk of hypertension and ischaemic heart disease compared to people who live in the same environment that do not experience sleep disturbance. Finally, exposure of hospitalized patients to relatively high levels of noise from sources inside or outside the hospital delays recovery and wound healing (Health Council of the Netherlands, 1996). Above specified types of people are also under the susceptible groups of population, affected by the soundscape scenario of Dhaka city.

**METHODOLOGY**

This research studied the soundscape scenario of six parks of Dhaka city through interviews with 120 park users and recording of sound levels through the use of an instrument (sound level meter). Questionnaire survey was performed including members of all the categories of the susceptible groups [boys-10%, girls-10%, male (up to 55 years)-30%, female (up to 55 years)-25%, male (55+ years)-20%, female (55+ years)-5%]. The data collection process was performed both on weekdays and weekends in the month of February 2011.



**Figure 1: Type and Proportion of Respondents**



**Advanced Sound Level Meter (TES-52A)**

**VEGETATION ZONES OF DHAKA CITY**

Vegetation zones of Dhaka City are scattered mainly in Agargaon, Dhanmondi, Khilgaon, Kamrangir Char,

Banani and Ramna area. Various green spaces are --Panthokunjo park, Shahidbagh park, Bahadur Shah park, Chaudhuripara Shishu park, Taltala High School, Vegetation around Dhanmondi lake, Vegetation around Gulshan lake, **Osmani Uddyan, Chandrima Uddyan, Ramna Park, Suhrawardi Uddyan, Shahid Matiur Park, Gulshan Tank Park**, etc. By now extinct or almost extinct parks are -- Kamlapur park, Karwan Bazar park, Shamibagh park, English Road park, etc. (Figure-2).



**Figure 2: Major Vegetation Zones of Dhaka City**



**Figure 3: Location of Parks taken as Case Study**

In this paper, six parks have been taken as case studies based on their historical importance, accessibility, surrounding land use and connecting road network. The taken case studied parks are -- Osmani Uddyan, Chandrima Uddyan, Ramna Park, Suhrawardi Uddyan, Shahid Matiur Park and Gulshan Tank Park (Figure-3).

**Ramna Park**

Ramna park is one of the most beautiful areas in Dhaka with lots of trees and a lake near its center. The park covers an area of 68.50 acres of which the lake takes 8.76 acres. Ramna Park accomodates 71 species of flowering plant, 36 species fruit bearing plant, 33 species medicinal plant and 41 species of forestry and 11 other species. Walkways inside the park are wide enough and urbanites can enter the park through five gates from different sides. The Park features a lot of beautiful and modern venues for relaxation. A number of people from far and close distance take their vehicles to visit the park and have an enjoyable walk in the midst of nature.



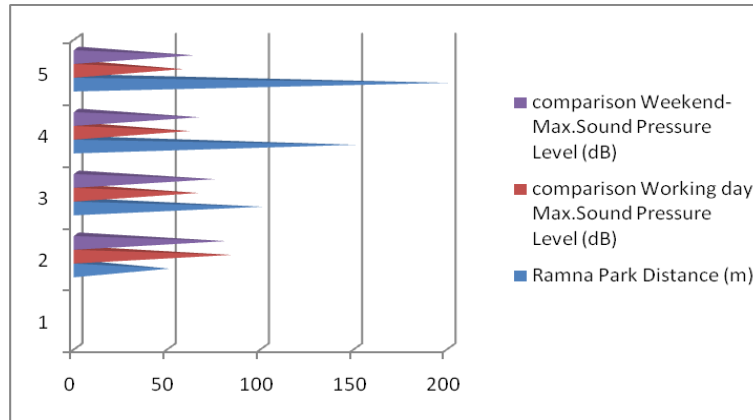
**Aerial View of Ramna Park taken from Google**



**Positions (Yellow Arrow) where the Measurements were taken in the Ramna Park**



**Entry and Internal Views of Ramna Park with Different Types of Trees Planted**



**Figure 4: Comparison of the Sound Pressure Level (dB) between Working Day and Weekend (Both Measurements were taken at the Same Time Period) in the Ramna Park**

From the bar chart, it is seen that, due to the presence of the foliage, sound level decreased as the listener entered more distance from the sound source (in case of working day). But the decrease of sound level is comparatively smaller and in most cases even higher than the sound level of working day, as many children play in the park in the weekends.

**Sahrawardi Uddyan**

**Suhrawardy Udyan**, formerly known as **Ramna Race Course** ground houses trees of a limited variety, which was evident during the survey. People love to move around, play, sit and also sleep in this park at different times of the day.



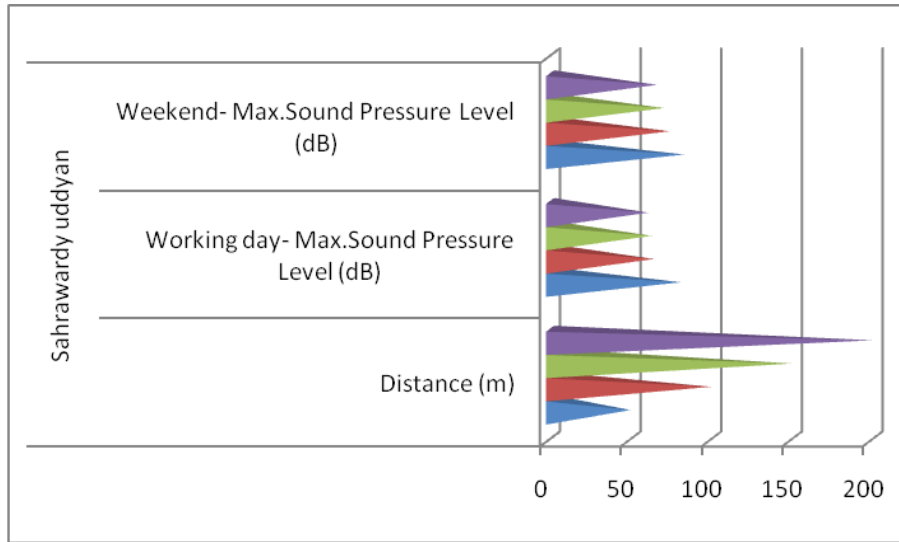
**Aerial View of Sahrawardi Uddyan taken from Google**



**Positions (Yellow Arrow) where the Measurements were taken in the Sahrawardi Uddyan**



**Internal Views of Sahrawardi Uddyan, People Moving around, Playing and Also Sleeping in the Park, a Limited Variety of Trees are Seen in the Photographs**



**Figure 5: Comparison of the Sound Pressure Level (dB) between Working Day and Weekend (Both Measurements are taken at the Same Time Period) in Sahrawardy Uddyayan**

From the chart, it is seen that, due to the presence of the foliage, sound level decreased gradually as the listener cross more distance from the sound source (in case of working day). But the decrease of sound level is comparatively smaller and in all cases higher than the sound level of working day, as a large amount of children and adults play, laughs and quarrel with excitement in the park in the weekends.

**Shahid Matiur Park**

Gulistan Park, now known as the Shahid Matiur Park, is situated in Gulistan and at present has been taken by Dhaka City Corporation as part of an initiative for beautification of the Park. The area of the park is 3.5 acres where Mahanagar Natya Mancha, a mosque, a small pond, a WASA pump, two public toilets and a Police box are located. Although it is a small park, yet a variety of trees were seen during the survey.



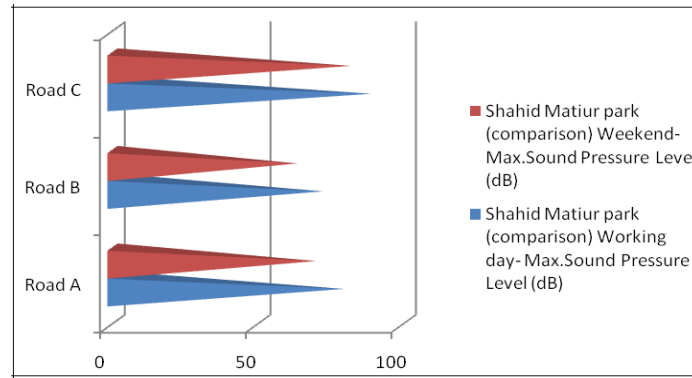
**Aerial View of Shahid Matiur Park taken from Google**



**Positions (Yellow Arrow) where the Measurements were taken in the Shahid Matiur Park**



**Internal Views of Shahid Matiur Park, People Moving around, Playing and Working in the Park, Construction Materials are Seen in the Photographs**



**Figure 6: Comparison between the Sound Pressure Level (dB) of Working Day and Weekend (Both Measurements are taken at the Same Time Period) in Shahid Matiur Park**

From the graphs and also from the physical survey, it is seen that, due to the presence of the foliage, sound level decreased gradually as the listener cross more distance from the sound source. The decrease of sound level in weekend is comparatively smaller than the sound level of working day. Presence of more busy road reduce less amount of sound (when entered 50 meters deep in the park), even if there is a lot of trees in the park.

**Osmani Uddyan**

The total area of the Osmani Uddyan is 23.34 acres. In Osmani Uddyan, people like to move around, sit for several hours and even sleep in the grass mounds. A variety of trees are seen in the clean and lively park.



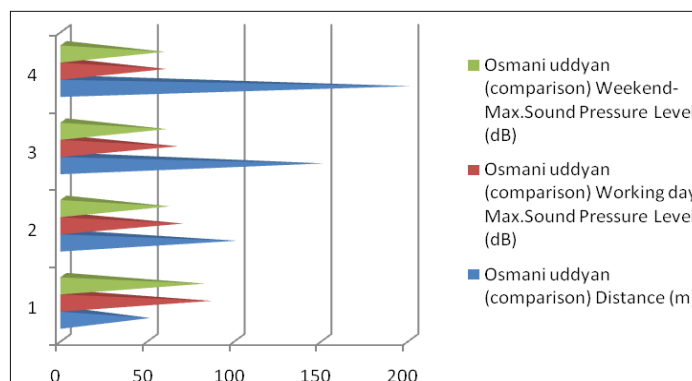
**Aerial View of Osmani Uddyan Taken from Google**



**Positions (Yellow Arrow) where the Measurements were taken in the Osmani Uddyan**



**Internal Views of Osmani Uddyan, People Moving Around, Sitting and Even Sleeping in the Grass Mounds in the Park, Clean and Lively Environment**



**Figure 7: Comparison between the Sound Pressure Level (dB) of Working Day and Weekend in Osmani Uddyan**

From the chart, it is seen that, due to the presence of the foliage, sound level decreased gradually as the listener cross more distance from the sound source (both in case of working day and weekend). The decrease of sound level is comparatively smaller but gradual in the weekend, as many children and adults play, laughs and quarrel with excitement inside the park.

**Chandrima Uddyan**

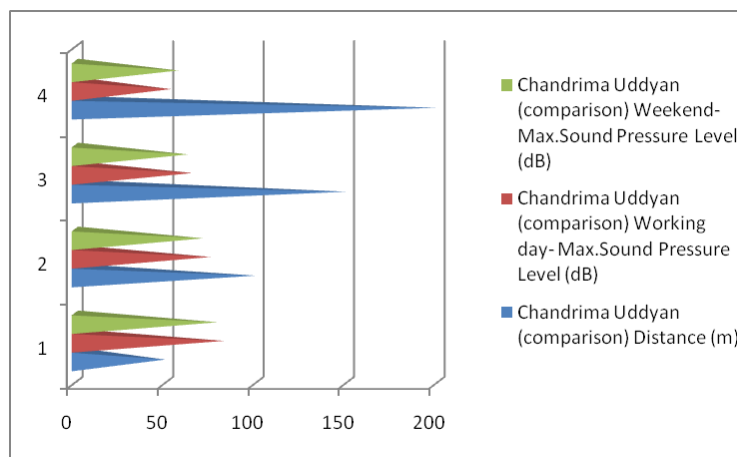
In Chandrima Uddyan, people love to move around, play cricket, sit for several hours, take lessons and gather while film shooting occurs. Lively environment of the park is attractions to the visitors and a large variety of trees are seen during the survey.



**Internal Views of Chandrima Uddyan, People Moving Around, Playing Cricket, Sitting, Taking Lessons and Gathering While Film Shooting in the Park; Lively Environment**



**Positions (Yellow Arrow) where the Measurements were taken in the Chandrima Uddyan**



**Figure 8: Comparison between the Sound Pressure Level (dB) of Working Day and Weekend (Measurements are taken at the Same Time Period) in Chandrima Uddyan**

From the physical survey and also from the bar chart analysis, it is seen that, due to the presence of the foliage, sound level decrease gradually as the listener cross more distance from the sound source (both in case of working day and weekend). The decrease of sound level is comparatively smaller but gradual in the weekend, as many children and adults play, film shootings occur, teaching to the (IELTS exam sitting) students occur and as people laughs and quarrel with excitement in the park.



**Gulshan Tank Park**

Gulshan Tank Park is situated in complete residential settings and the characteristic of this park is slightly different from the other surveyed parks.

Although children play cricket, people sits, but mainly most of the people in the park perform their evening walk and freehand exercise in the clean and lively environment of the park.



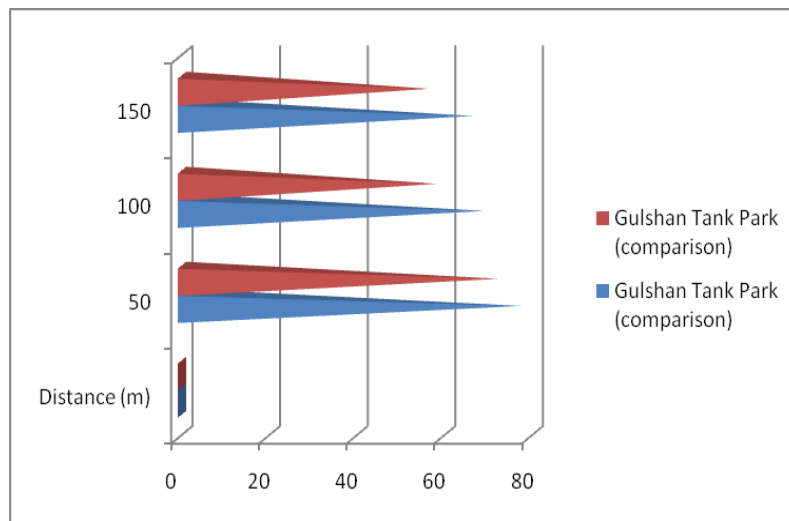
**Aerial View of Gulshan Tank Park taken from Google**



**Positions (Yellow Arrow) where the Measurements were taken in the Gulshan Tank Park**



**Internal Views of Gulshan Tank Park, People Performing Evening Walk and Freehand Exercise, Playing Cricket, Sitting in the Park; Clean and Lively Environment**



**Figure 9: Comparison between the Sound Pressure Level (dB) of Working Day and Weekend in Gulshan Tank Park**

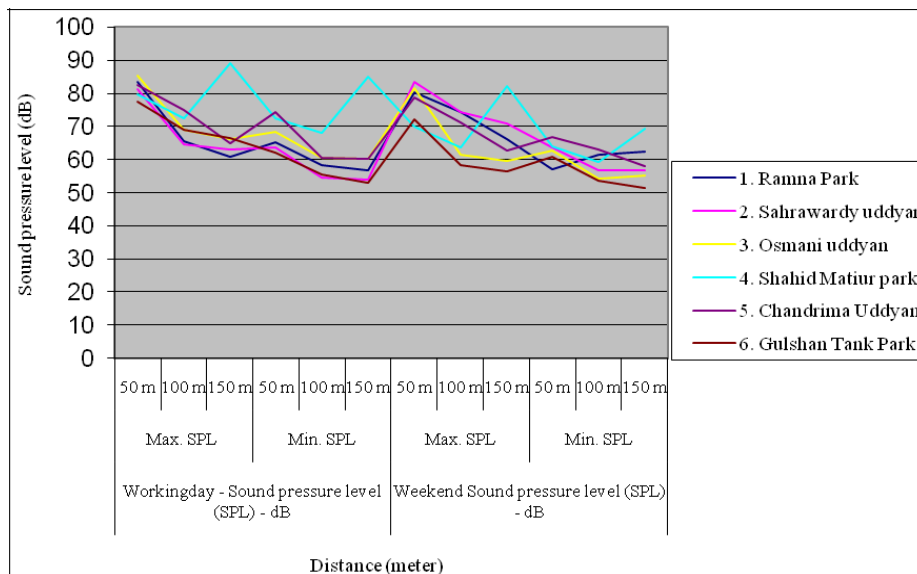
From the physical survey and also from the graph, it is evident that, due to the presence of the thick foliage, sound level decrease gradually as the listener cross more distance from the sound source (both in case of working day and weekend). The decrease of sound level in the park is comparatively higher but gradual in the weekend, as the surrounding roads become much quiet (due to the holiday).

**FINDINGS**

**Table 1: Sound Pressure Level (SPL) at Different Distance from Vehicular Roads on Working Day and Weekends**

| Name of Park          | Working Day - Sound Pressure Level (SPL) - dB |       |       |          |       |       | Weekend Sound Pressure Level (SPL) - dB |       |       |          |       |       |
|-----------------------|---|-------|-------|----------|-------|-------|---|-------|-------|----------|-------|-------|
|                       | Max. SPL                                      |       |       | Max. SPL |       |       | Max. SPL                                |       |       | Max. SPL |       |       |
|                       | 50 m  | 100 m | 150 m | 50 m     | 100 m | 150 m | 50 m                                    | 100 m | 150 m | 50 m     | 100 m | 150 m |
| 1. Ramna Park         | 83.4  | 65.7  | 60.8  | 65.3     | 58.5  | 56.8  | 80.3                                    | 74.4  | 66.1  | 57.1     | 61.4  | 62.4  |
| 2. Sahrawardy uddyan  | 81.2  | 64.5  | 63    | 63.6     | 54.6  | 54    | 83.3                                    | 74.3  | 70.8  | 63.8     | 56.8  | 56.9  |
| 3. Osmani uddyan      | 85.3  | 68.9  | 66    | 68.2     | 60.4  | 60.1  | 81.6                                    | 61.2  | 59.4  | 62.7     | 54.1  | 55.2  |
| 4. Shahid Matiur park | 79.6  | 72.3  | 89    | 72.4     | 68    | 85    | 70                                      | 63.6  | 82    | 64       | 59.3  | 69.3  |
| 5. Chandrima Uddyan   | 82.6  | 75.1  | 65    | 74.5     | 60.4  | 60.1  | 78.9                                    | 71.1  | 62.6  | 66.9     | 62.9  | 57.9  |
| 6. Gulshan Tank Park  | 77.4  | 69    | 66.4  | 62.2     | 55.7  | 53    | 72.2                                    | 58.3  | 56.4  | 60.8     | 53.8  | 51.5  |

**Source:** Field survey, 2011 (using advanced sound level meter)



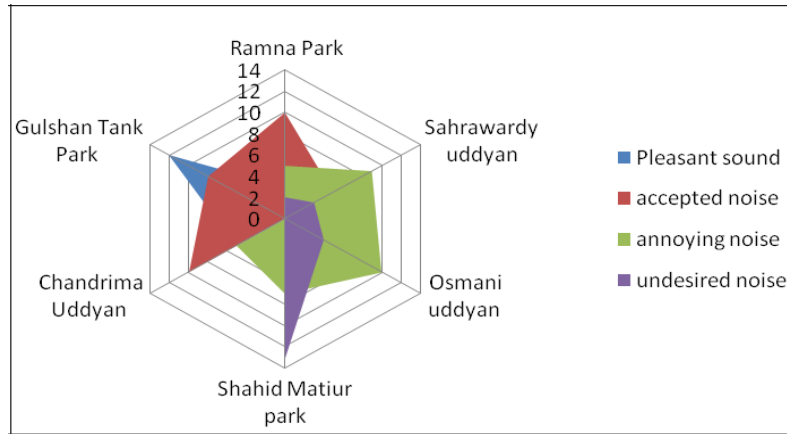
**Source:** Field Survey, 2011

**Figure 10: Comparison of Sound Pressure Level Among D ifferent Parks**

From table-1 and also from the graph above it is evident that, Shahid Matiur park is the most noisy among the six studied parks both on working days and weekends, due to its small area, adjacent busy roads with heavy vehicular noise. Even the plantation within the park (Shahid Matiur park) is not sufficient enough to create a thick buffering from sound pollution inside the park.

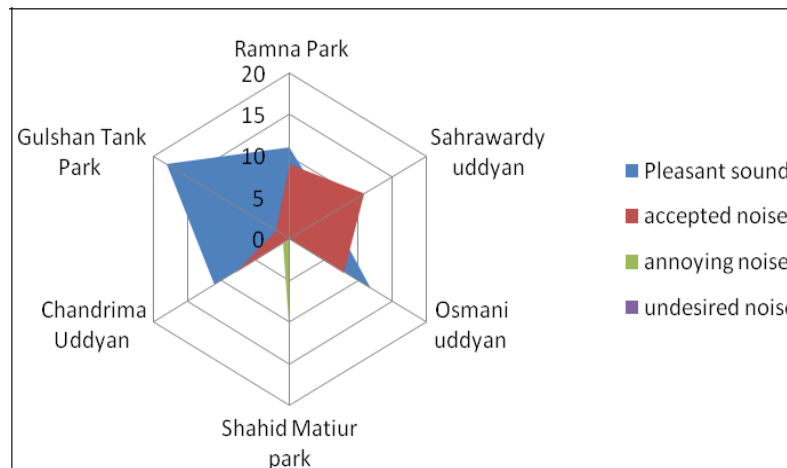
On the other hand, Gulshan Tank park is the least noisy among all the studied parks. Although it is small in size, but due to its location within the residential area, adjacent moderate noisy roads, undulation in landscape and thick layer of plantation which works as sound barrier, this park is enjoyable to its users from the viewpoint of soundscape scenario. In Osmani Uddyan a special feature was seen; green mounds creating undulation in the landscape, which has certain effects on the noise reduction within the park.

Besides, location of the park within the administrative zone of the city makes this park less noisy on the weekends from working days. Again, due to a large number of users of different age group this park remains very lively on the weekends and becomes a bit noisy on certain parts as people laughs, quarrels and children plays with excitement. From the remaining three studied parks, Ramna park and Sahrawardy Uddyan are less noisy on working days, rather than on weekends; while Chandrima Uddyan is more noisy on working days.



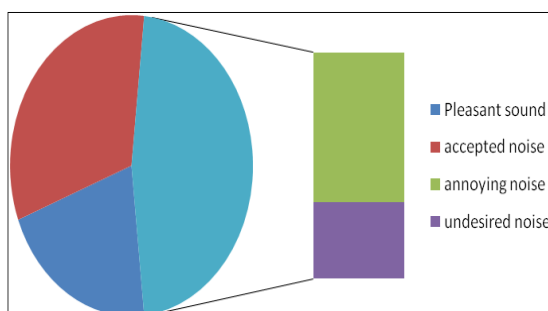
**Figure 11: Perception of Sound Level by the Urbanites on Working Day**

The result of the questionnaire survey shows that (Figure 11), during working days visitors of the Gulshan Tank park perceived the sound level as pleasing; while on the other hand, most of the visitors of the Shahid Matiur park nominated the soundscape scenario within the park as undesired noise. In Osmani Uddyan, Sahrawardy Uddyan and Shahid Matiur park, a large number of users perceived the sound level as annoying noise. While in Ramna park and in Chandrima Uddyan, the users were more or less satisfied with the sound level and categorized it as accepted noise.

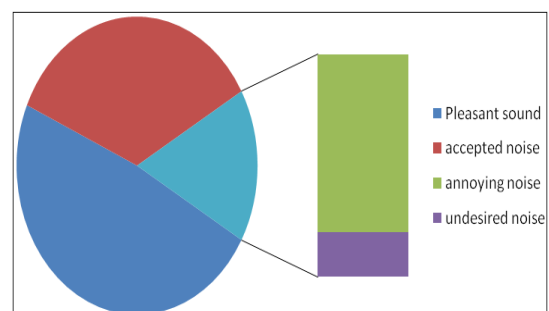


**Figure 12: Perception of Sound Level by the Urbanites on Weekend**

During weekends (Figure 12), almost all the users of the Gulshan Tank park perceived the pleasant level of sound with full satisfaction within the park. A large number of users of the Chandrima Uddyan and Ramna Park were satisfied with the pleasant sound level. While a large number of users of the Sahrawardy Uddyan, osmani Uddyan and Ramna park mentioned the sound level as accepted noise. A number of visitors of the Chandrima Uddyan found the sound level as accepted noise. While in Shahid Matiur park a number of users mentioned the sound level as annoying noise.



**Figure 13: Overall Satisfaction Level of the Users on Working Day**



**Figure 14: Overall Satisfaction Level of the Users on Weekends**

From the result of the questionnaire survey (Figure 13) it is found that, during working days 20% of the visitors of the studied parks perceived pleasant sound, 33% mentioned accepted noise level, 31% found annoying noise and the remaining 16% specified as undesired noise. Whereas, during weekends (Figure 14), 48% of the visitors of the studied parks perceived the level of sound as pleasant sound, 35% mentioned accepted level of noise, 13% found annoying noise and only 4% specified as undesired noise.

From the analysis of the mechanical data and the interviewed data, it is evident that, vehicular noise pollution matters a lot in perceiving the soundscape scenerio of the parks of urban Dhaka. As a whole, the data reveal a prevalence of mechanical sounds and a hierarchy of preference for natural over people and mechanical sounds. There was a link between sound levels, both objective and perceived, and the type of sounds heard. The presence of these sounds varied across sites in part due to the undulation on the ground level, size of the park, depth of the trees on the street side, location of the park (how much noisy the surroundings are) and also in relation to the ecological qualities of the place, specifically the presence of birds and shrub vegetation.

The results suggest that people's opportunity to access quiet, natural places (parks) in urban areas can be enhanced by improving the ecological quality of urban parks and reducing the vehicular noise pollution through targeted planning and design.

## CONCLUSIONS

One of the few key elements to determine the urban quality of life includes the examination of the soundscape scenario of the urban parks. In Dhaka, most areas, old or new, are developed spontaneously with both unplanned and a little planned manner, which already reduced the number of parks in the city and therefore have very little scope for creating any new park. In such a status of the urban Dhaka, the authorities concerned as well as the respective area dwellers should be more conscious in retaining the best possible level of soundscape scenario in the parks by enhancing the ecological quality of the parks and reducing the noise pollution level in the existing parks of the city through targeted planning and design and call others to join effort. Thus, upholding the sustainable urban quality of life in terms of soundscape scenario in the parks of Dhaka city will turn into a reality.

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