

# An analytical study Of Vehicular Effects on Sound in Residential, Silent And Mixed zones Of Sylhet

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## Abstract

Noise is a form of environmental pollution that influences our life and comfort. Because of growing populations and increasing urbanization, noise is more common and is getting worse. Sylhet is one of the Bangladesh's most rapid growth cities. In recent years, it has experienced unprecedented population increase. During the past decades, there has been a noticeable growth in the number of individuals moving to Sylhet City from other regions of the nation, particularly for jobs and education. As the lifestyle and facilities of this city increase compared to the suburbs and countryside areas, nowadays vast amounts of individuals are interested in living in the Sylhet city. As the population is increasing, the number of transport facilities (volume of vehicles) are also increasing. To be more specific, the number of private cars ownership is increasing day by day. As a result, now the sound level is increasing much more than the standard level. Throughout the working days, between 6 am and 12 am, noise levels were monitored at 15 significant places (residential, silent and mixed zones) across the city. A sound meter was used to conduct the study. Vehicular data were converted to passenger car unit (PCU) conversion factor. Geometric design standard manual (LGED, 2005) was used to calculate PCU by passenger car factor or passenger car equivalent. "Environmental conservation rules-1997" was considered as basic to analyze the data. The study was conducted to quantify the amount of noise pollution that happens in the city's mixed, residential, and silent zones. It also revealed the impact of vehicular noise. It was found that most of the time the sound level at every site remained consistently much above the allowable limit and vehicular noise played a significant role in every case.

**Keywords:** Noise, PCU, Silent Zone, Residential Zone, Mixed Zone.

## Highlights

- Revealed significant vehicular noise impact in residential, silent, and mixed zones.
- Identified sound levels consistently exceeding allowable limits throughout the day.
- Utilized passenger car unit (PCU) conversion factor to quantify vehicular noise pollution.
- Emphasized the urgent need for noise pollution control measures in Sylhet.

## 1 Introduction

Sound, a common aspect of our lives, serves as a source of communication and pleasure for most animals, including humans. Also, it has a powerful alarm system. A low sound is pleasant, but a loud sound is unpleasant and is frequently referred to as "noise." Unwanted and unpleasant sounds that occur at the incorrect time or place are referred to be noise [1]. Sound waves are a type of "chain reaction" movement that continues until the molecules run out of energy. As a result, while the sound wave travels through the air, there are numerous molecular collisions, but the air molecules themselves do not move with the wave. Each molecule just travels away from a resting position but ultimately returns to it when it is disturbed [2]. Sound pollution has been identified as a serious threat to people's quality of life across the world. Due to the high population density and the abundance of personal property there, urban regions are particularly vulnerable to this lethal goal. Although industries, unrestricted loudspeaker use, and construction activities like drilling are sources of noise pollution, vehicles are thought to be the primary culprit in cities. A sound level meter was used to measure the volume. Decibels (dB) are used to quantify noise intensity. Exposed to 45 dB of noise, the average individual cannot sleep. Hearing impairment starts at a slightly lower volume, about 85 dB, before the ear perceives discomfort around 120 dB [3]. Noise is defined as any undesirable sound. Sound is a type of energy generated by a vibrating body that, when it reaches the ear, provides the experience of hearing via nerves. All vibrating bodies create no audible sounds. The audible frequency ranges from 20 to 20,000 hertz [4]. Sounds with frequencies less than 20 hertz are referred to as infrasonic, whereas sounds with frequencies more than 20,000 hertz are referred to as ultrasonic. Because noise is also a sound, the terms noise and sound are used interchangeably throughout this module. Noise pollution is a serious health risk not only for Bangladesh but also the current world. Millions of people in Bangladesh are at danger for a variety of health problems owing to noise pollution, including everything from deafness to heart attacks. The hydraulic horns of moving cars, microphones, and tape players may all contribute to noise pollution on city streets. The hydraulic horns used by buses, lorries, scooters, and other vehicles on congested city streets are harmful to people. This is also how noise pollution in Sylhet City affects hundreds of children's hearing every day. Particularly for kids, the horns are quite harmful. Loud sounds like radios, televisions, tape players, and microphones, as well as mills and factories, can all be harmful to a child's health. Noise is not only hazardous to people's health, but also impacts the manner individuals. According to experts, if a kid under

the age of three hears a horn releasing 100 dB of noise at close range, they risk losing their hearing [5]. Humans typically detect sounds at a frequency of 15 to 20 kilohertz (KHz). The World Health Organization (WHO) states that a man can become momentarily deaf at 60 decibels and completely deaf at 100 decibels and The ideal sound conditions for Bangladesh, according to the Department of Environment (DoE), are 45 dB during the day and 35 dB at night in quiet areas, 50 dB during the day and 40 dB at night in residential areas, 60 dB during the day and 50 dB at night in mixed areas (residential, commercial, and industrial localities), 70 dB during the day and 60 dB at night in commercial areas, and 75 dB during the day and 70 dB at night in industrial areas [6]. The primary modes of transportation inside the city corporation are the tempo (motor), simple bike, van, and vehicle (CNG). According to a Bangladesh Bureau of Statistics (BBS) study, Sylhet City Corporation's roadways were home to both registered and unregistered paratransit modes in 2011. In Sylhet city, non-motorized vehicles like rickshaws (human-powered), easy bikes (battery-powered), and vans were the most common types of paratransit [7]. In the metropolitan area of Sylhet city, the number of motorized vehicles has significantly expanded, and many travelers from all over the nation, particularly those from the northeast, have selected Sylhet City as their destination. Due to this development, the city is now quite busy and loud [8]. Together with registered vehicles, a considerable percentage of unregistered vehicles entered the discussion area as well. There were more unregistered cars than registered ones on the roads of Sylhet city for motorized paratransit modes including auto-rickshaws and tempo. In the city of Sylhet, vans are frequently utilized to move items from one location to another. Moreover, motorized vehicles like the Laguna and Tempo were accessible throughout Sylhet [9]. Vehicles amount, sound pollution and its effect are mainly related to population volume. In 2020, the population was 851,808 and in 2024, this amount is 999,374 and the growth rate is 3.64% from 2023 [10]. Although the impacts of noise pollution are well acknowledged on a global scale, the residents of Sylhet feel powerless since no one is doing action despite their severe suffering because of the city's increasing noise pollution. . All those backgrounds of the study, the objective of the study has been defined as to determine the vehicle effects on sound in residential, silent, and mixed zones of Sylhet city. This research makes a small effort to comprehend the degree of noise pollution and vehicle effect in the city of Sylhet.

## 2 Methodology

Silent Zones are defined as areas within a radius of 100 meters of hospitals, educational institutions, or special

institutions/ to be specified by the government, where the use of vehicle horns or other auditory signals, and loudspeakers is restricted [11].

**Table 1.** List of Silent Zone locations

Silent Zone	Latitude & Longitude
1. M.C College Gate, Tamabil road, Sylhet.	24°53'50.5"N-91°54'06.5"E
2. Sylhet Law College, Uposhohor, Sylhet.	24°53'08.7"N-91°52'51.0"E
3. RagibRabeya H. Gate, Pathantola, Sylhet.	24°54'46.9"N-91°51'07.0"E
4. Mount Adora H. Gate, Akhalia, Sylhet.	24°54'36.3"N-91°54'38.3"E
5. National Heart Foundation, Sylhet.	24°54'27.8"N-91°53'15.8"E

A mixed zone, which is a geographically integrated blend of household, business, social to cultural, and public transportation uses, concentrates activity inside a building or community [12]

**Table 2.** List of Mixed Zone locations

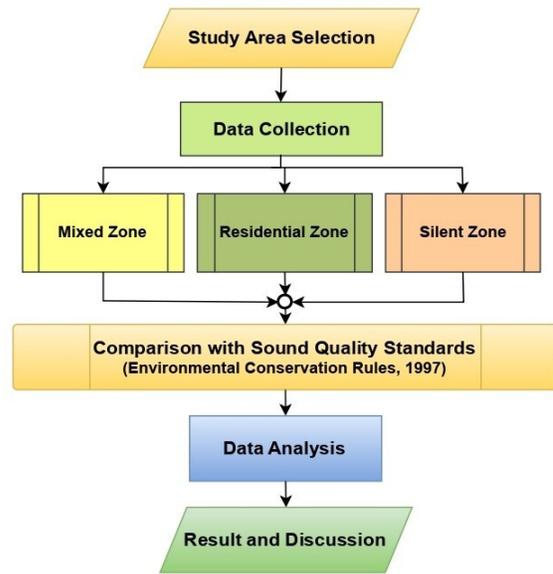
Mixed Zone	Latitude & Longitude
1. Subhanighat ,Kacha bazar Road, Sylhet.	24°53'20.0"N 91°52'47.7"E
2. Kodomtoli Point, Sylhet.	24°52'43.9"N 91°52'38.5"E
3. Tilagor Point, Tamabil Road, Sylhet.	24°53'46.3"N 91°54'00.8"E
4. Shurma Tower, Taltola Rd, Sylhet.	24°53'25.9"N 91°52'03.0"E
5. Amborkhana Point, Near Mosque, Sylhet	24°54'18.6"N 91°52'11.3"E

A residential area is defined as a region inside any built-up area that is principally residential and is displayed on a noise limit plan [13].

**Table 3.** List of Residential Zone locations

Residential Zone	Latitude & Longitude
1. Shaplabag A/A, 2 no Road, Sylhet.	24°53'37.0"N-91°54'01.6"E
2. Shunarpara A/A, Shibgonj, Sylhet.	24°53'32.6"N-91°53'15.5"E
3. Housing Estates, Lane 3, Sylhet.	24°54'32.8"N-91°51'58.9"E
4. Shahjalal Uposhohor, D block, Sylhet.	24°53'22.0"N-91°53'08.9"E
5. Nipobon A/A, R/A, Shahporan RD, Sylhet.	24°53'41.7"N-91°52'07.4"E

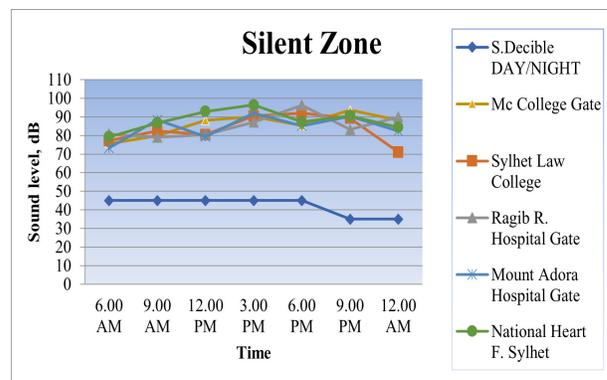
“Environmental Conservation Rules-1997” state that the hours between 6 a.m. and 9 p.m. are considered the day-time. The hours between 9 p.m. and 6 a.m. are considered as nighttime [11].



**Fig 1.** Working Process

### 3 Results and Discussion

According to “Environment Conservation Rules, 1997”, M.C College Gate, Tamabil Road, Sylhet, Sylhet Law College, Uposhohor Point, Ragib Rbeya Hospital Gate, Pathantola, Mount Adora Hospital Gate, Shunamgonj Highway & National Heart Foundation Sylhet, East Shahi Eidgah were considered as Silent Zone.



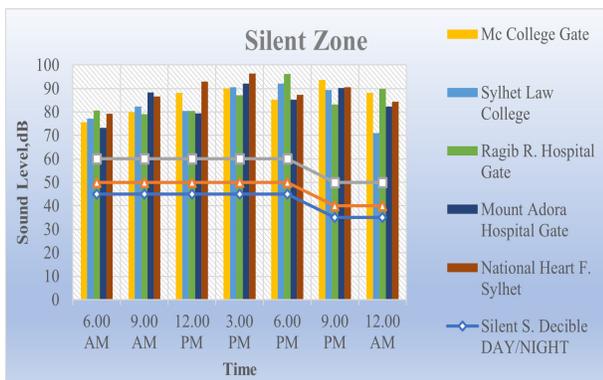
**Fig 2.** Comparison between Standard Value and Observe Data for Silent Zone

Figure 2 was established to compare between standard

**Table 4.** Standards for sound [11]

Standards for sound			
SI. No.	Category of Area/Zone	Limits in dB	
		Daytime	Nighttime
A	Silent Zone	45	35
B	Residential Zone	50	40
C	Mixed Zone (mainly residential area, and simultaneously used for commercial and industrial purposes)	60	50

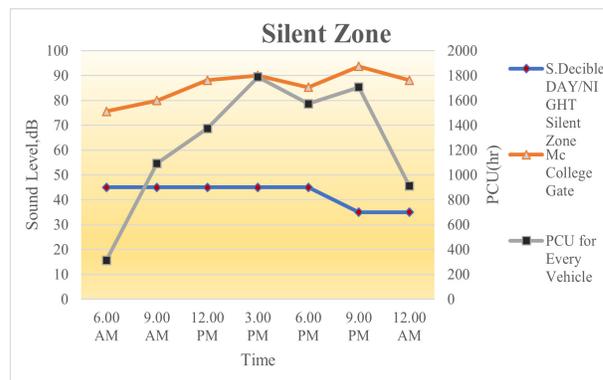
value and observe data for silent zone. From 6:00 AM to 12 AM the sound level was above the allowable level of the silent zone. It was maximum at 3:00 PM (96.4 dB) in National Heart F. Sylhet and minimum at Figure 2 was established to compare between standard value and observe data for silent zone. From 6:00 AM to 12 AM the sound level was above the allowable level of the silent zone. It was maximum at 3:00 PM (96.4 dB) in National Heart F. Sylhet and minimum at 12:00 AM (71 dB) in Sylhet Low College Gate.



**Fig 3.** Relation between silent zone with all the zone Standard Decibel

In the chart (Figure 3), the standard decibel at day and nighttime of silent zone, residential zone, and mixed zone were presented by line diagram where vertical column indicated the collected data from silent zone. But every point and time collected data was above the standard sound level limits of silent zone according to “Environmental Conservation Rules-1997”, not even satisfied the residential and mixed zone standard limit.

In this graph (Figure 4) values of PCU were contained on the right side and values of Sound Level in left side. To analyze the vehicular effect the busiest point and all the statistics deviation is high also pair with the definition of the “Environmental Conservation Rules-1997” (MC college gate) was considered. The sound level at MC college



**Fig 4.** Passenger Car Unit PCU Sound Level at MC College Gate in Silent Zone

gate was 75.6 dB, and PCU value was 313.2 at 6:00 AM. From figure 4, the sound level increased and decreased with the PCU value. For PCU value 1788, sound level was maximum ( 90 dB) at 3:00 PM. To keep the area silent, it is necessary to maintain PCU value less than 300.

According to “Environment Conservation Rules, 1997”, Shaplabag A/A, 2 no Road, Shunarpara A/A- Shibgonj, Uposhohor Point, Housing Estates-Lane 3, Shahjalal Uposhohor- D block, & Nipobon A/A- Nipovon R/A were considered as Residential Zone.

Figure 5 was established to compare between standard value and observe data for residential zone. From 6:00 AM to 12 AM the sound level was above the allowable level of the silent zone except Housing Estates-Lane 3 at 6:00 AM. It was maximum at 6:00 PM (93.2 dB) in Shahjalal Uposhohor- D block and minimum at 6:00 AM (50.4 dB) in Housing Estates-Lane 3.

In the chart (Figure 6), the standard decibel at day and nighttime of silent zone, residential zone, and mixed zone were presented by line diagram, where vertical column indicated the collected data from residential zone. But every point and time collected data was above the standard sound level limits of residential zone according to “Environmental Conservation Rules-1997”, Only the point Shu-

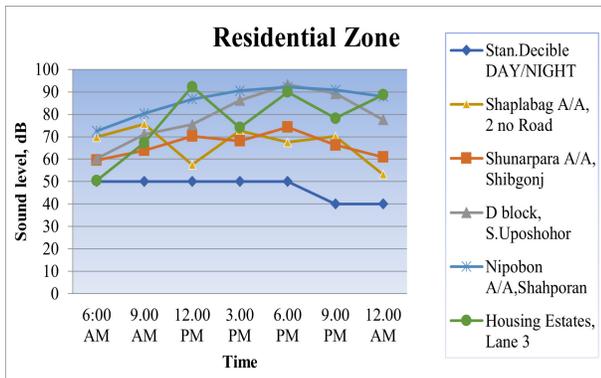


Fig 5. Comparison between Standard Value and Observe Data for Residential Zone

In this graph (Figure 7) values of PCU were contained on the right side and values of Sound Level in left side. The sound level at Housing Estates-Lane 3 was worst compared with study areas (residential zone). PCU value was 12.6 at 6:00 AM, and the sound level at was 50.4dB. The sound level increased with the PCU value. For PCU value 34.8 sound level was maximum (92.3 dB) at 3:00 PM. To keep the area silent according to residential zone recommendation level, it is necessary to maintain PCU value less than 12.

According to “Environment Conservation Rules, 1997”, Subhanighat, Kacha Bazar Road, Kodomtoli Point, Tilagor Point- Tamabil Road, Shurma Tower, Taltola Rd & Amborkhana Point were considered as Mixed Zone.

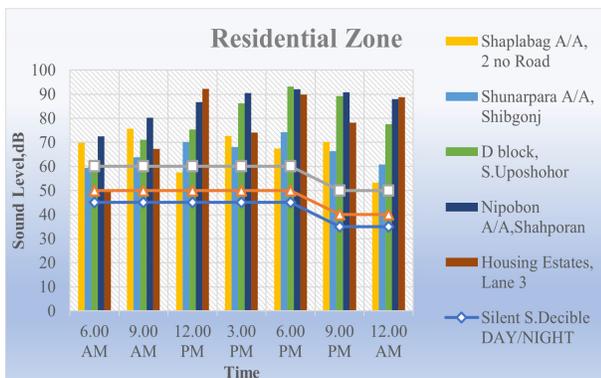


Fig 6. Relation between Residential zone with all the zone Standard Decibe

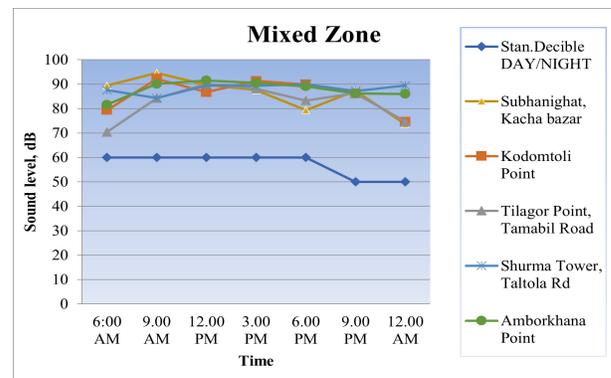


Fig 8. Comparison between Standard Value and Observe Data for Mixed Zone

narpara A/A-Shibgonj (59.5 dB) and Shahjalal Uposhohor-Dblock (60.1 dB) at 6.0 am collected data is around matched with mixed zone noise limit but more than Silent and Mixed zone standard limit. And Housing Estates-Lane 3 (50.4 dB) at 6:00 AM matched with residential zone sound level limit.

Figure 8 was established to compare between standard value and observe data for mixed zone. From 6:00 AM to 12 AM the sound level was above the allowable level of the mixed zone. It was maximum at 9:00 AM (94.6 dB) in Subhanighat, Kacha Bazar Road and minimum at 6:00 AM (70.4 dB) in Tilagor Point- Tamabil Road.

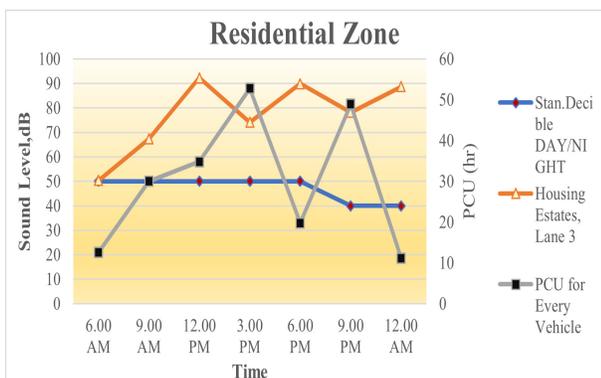


Fig 7. Passenger Car Unit PCU Sound Level at Housing Estate Lane 3 in Residential Zone

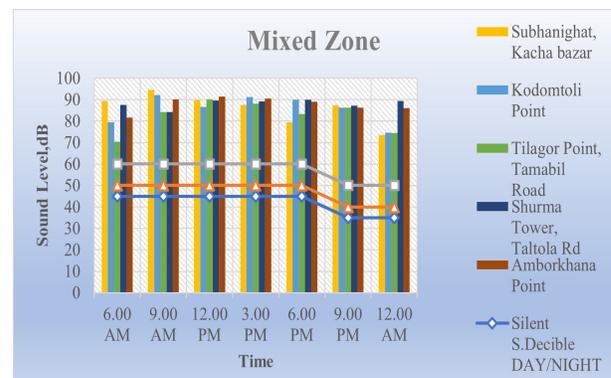
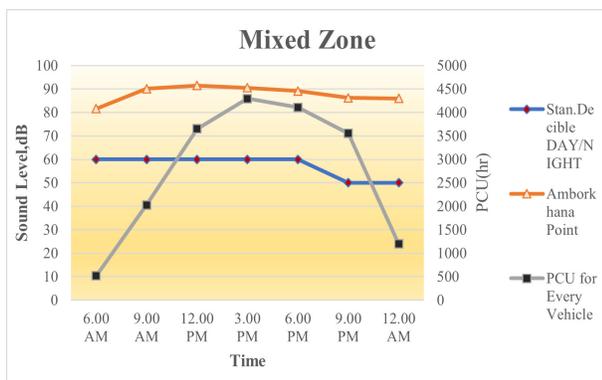


Fig 9. Relation between Mixed zone with all the zone Standard Decibel

In the chart (Figure 9), the standard decibel at day and

nighttime of silent zone, residential zone, and mixed zone were presented by line diagram where vertical column indicated the collected data from mixed zone. But every point and time collected data was above the standard sound level limits of mixed zone according to "Environmental Conservation Rules-1997", not even satisfied the residential and silent zone standard limit.



**Fig 10.** Passenger Car Unit PCU Sound Level at Amborkhana Point in Mixed Zone

In this graph (Figure 10) values of PCU were contained on the right side and values of Sound Level in left side. The sound level at Amborkhana Point was worst compared with study areas (Mixed zone). PCU value was 516 at 6:00 AM, and the sound level was 81.6dB. From figure 10, the sound level increased and decreased with the PCU value. For PCU value 3649.5 sound level was maximum (91.5 dB) at 12:00 PM. To keep the area silent according to mixed zone recommendation level, it is necessary to maintain PCU value less than 500.

## 4 Conclusion

The analysis showed that Sylhet City's Mixed Zones, Residential Zones, and Silent Zones are extremely susceptible to noise pollution. One of the primary factors that contribute to noise pollution in cities is traffic. The level of noise pollution presents in the residential, mixed, and quiet areas of the city was examined in the study. In the silent zone the standard sound level in the daytime is 45dB and at nighttime is 35dB. But the collected maximum sound level was 96.4 dB and minimum sound level was 71dB. For Residential zone, standard sound level at daytime is 50dB and at nighttime is 40dB. However, the recorded minimum sound level was 53.2dB and the recorded highest sound level was 90.9dB. While considering Mixed zone, standard sound level at daytime is 60dB and at nighttime is 50dB. But considering the amount of data gathered at day and nighttime, the highest sound

level was 94.6dB and the minimum sound level was 70.4dB. In every case sound level was not up to the mark as per "Environmental Conservation Rules-1997" and the major contributing factor was vehicular noise. **website name1**

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