Chapter 5

Analysis

5.1 Introduction

In this chapter detailed analysis of collected noise level, traffic volume, and noise annoyance data is performed and results were presented. It includes measured noise level and its analysis, noise level pattern in various zones, frequency analysis of noise, traffic composition and noise annoyance at interrupted flow and uninterrupted flow conditions. The equivalent noise (Leq), percentile levels (Lmin, L90, L50, L10 and Lmax), The traffic noise index, noise pollution level (Lnp) and noise climate (NC) were computed from the noise database.

5.2 Noise Descriptors

5.2.1 Assessment of Noise Descriptors at interrupted flow condition

Noise levels in dBA are recorded at a rate of 2-second interval at interrupted flow condition and data were analyzed for 15 minutes interval to evaluate noise descriptors in the form of Lmax, Lmin, L10, L50, L90, Leq, Lnp, and TNI & NC (Noise climate) on all selected locations. The Bar chart is prepared to know the variation of noise descriptors, which is shown in Fig No. 5.1

At interrupted flow condition, average noise descriptors are observed as Lmax-93.26 dBA, Lmin-28.14 dBA, L10-77.39 dBA, L50-70.20 dBA, L90-64.55 dBA, and Leq-73.22 dBA and Lnp, TNI and NC are observed as 86.06, 85.69 and 12.84 resp.

5.2.2 Assessment of Noise Descriptors at uninterrupted flow Condition

Noise levels are dBA are recorded at uninterrupted flow condition. Traffic noise level data were analyzed to evaluate noise descriptors in the form of Lmax, Lmin, L10, L50, L90, Leq, Lnp, and TNI & NC (Noise climate).
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The Bar chart is prepared to know the variation of noise descriptors, which is shown in Fig No. 5.2.

Traffic Noise descriptors

Figure No. 5.1. Variation in Traffic noise descriptors at Interrupted flow condition

Traffic Noise descriptors

Figure No. 5.2. Variation in Traffic noise descriptors at uninterrupted flow condition
Assessment and Modelling of Noise Levels due to Vehicular traffic flow

At uninterrupted flow condition, average noise descriptors are observed as $L_{\text{max}}$-93.55 dBA, $L_{\text{min}}$- 39.13 dBA, $L_{10}$- 76.67 dBA, $L_{50}$- 68.32 dBA, $L_{90}$- 61.11 dBA, and $L_{\text{eq}}$-72.55 dBA and $L_{\text{NP}}$, TNI and NC are observed as 90.06, 97.90 and 16.65 resp.

5.3 Noise Levels Pattern in Various Zones

Noise level pattern is studied at study locations in various zones, the noise parameters indicate that, the values exceeds the prescribed limit.

The average data observed is presented in Table No.5.1

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Location Type of zone</th>
<th>Location Type of zone</th>
<th>$L_{10}$</th>
<th>$L_{\text{eq}}$</th>
<th>$L_{\text{NP}}$</th>
<th>TNI</th>
<th>NC</th>
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<tr>
<td>1</td>
<td>MER-NB Silence Zone</td>
<td>81.18</td>
<td>76.60</td>
<td>97.40</td>
<td>113.59</td>
<td>20.81</td>
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<td>2</td>
<td>AR-OCR Silence Zone</td>
<td>76.28</td>
<td>72.17</td>
<td>89.14</td>
<td>97.17</td>
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<td>69.17</td>
<td>87.45</td>
<td>102.49</td>
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<td>4</td>
<td>MER-WB commercial zone</td>
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<td>75.21</td>
<td>92.56</td>
<td>100.88</td>
<td>17.35</td>
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<td>5</td>
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<td>74.16</td>
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<td>6</td>
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<td>83.20</td>
<td>80.47</td>
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5.3.1 Silence zone (MER-NB & AR-DCR)

The noise levels recorded at silence zone exceeded the prescribed standard of 50 dBA. The average values of $L_{10}$ ranges 74.71-81.18 dBA,
Assessment and Modelling of Noise Levels due to Vehicular traffic flow

Leq ranges from 71.29 - 76.60 dBA, LNP ranges 88.28 - 97.40 dBA, TNI ranges 95.66 - 113.59, NC ranges 16.49 - 20.81. (Ref. Table No. 5.1)

5.3.2 Commercial zone (MER-EB, MER-WB & AR-IGM)

The noise levels recorded at commercial zone exceeded the prescribed standard of 65 dBA. The average values of L10 ranges 75.68 - 80.57 dBA, Leq ranges from 69.17 - 75.21 dBA, LNP ranges 83.20 - 89.92 dBA, TNI ranges 80.47 - 105.81, NC ranges 11.60 - 19.35. (Ref. Table No. 5.1)

5.3.3 Residential zone (MER-SB)

The noise levels recorded at residential zone exceeded the prescribed standard of 55 dBA. The average values of L10 ranges 78.05 - 81.03 dBA, Leq ranges from 73.49 - 75.29 dBA, LNP ranges 87.16 - 90.48 dBA, TNI ranges 89.09 - 95.92, NC ranges 13.67 - 15.20. (Ref. Table No. 5.1)

5.3.4 Heavy traffic zone (SBI & BSI)

The average values of L10 ranges 75.10 - 79.86 dBA, Leq ranges from 71.01 - 75.19 dBA, LNP ranges 81.05 - 89.56 dBA, TNI ranges 78.18 - 93.13, NC ranges 9.31 - 15.34. (Ref. Table No. 5.1)

5.4 Frequency Analysis Of Noise Levels

5.4.1 Frequency analysis of noise levels at interrupted flow condition

The 2 sec interval recorded data is analyzed for frequency distribution to know the % occurrence of particular noise level range at interrupted traffic flow condition. A Bar chart is prepared and shown in Figure No. 5.3. & 5.4
Assessment and Modelling of Noise levels due to Vehicular traffic flow

Figure No. 5.3 Frequency distribution of noise level range on various approaches at SBI

Figure No. 5.4 Frequency distribution of noise level range on various approaches at BSI
Assessment and Modelling of Noise levels due to Vehicular traffic flow

Analysis shows that, at SBI, averagely 50% of times noise level ranges from 61 – 70 dBA, 42% of times noise level ranges from 71 – 80 dBA, 1% of times noise level ranges from 51 – 60 dBA and 5% of times noise level ranges from 81 – 90 dBA. Overall 92% of times noise levels are exceeding 60 dBA.

Analysis shows that, at BSI, averagely 42% of times noise level ranges from 61 – 70 dBA, 50% of times noise level ranges from 71 – 80 dBA, 1% of times noise level ranges from 51 – 60 dBA and 5% of times noise level ranges from 81 – 90 dBA. Overall 92% of times noise levels are exceeding 60 dBA.

5.4.2 Frequency analysis of noise levels at uninterrupted flow condition

The 2 sec interval recorded data is also analyzed for frequency distribution to know the % occurrence of particular noise level range. A Bar chart is prepared and shown in Figure No.5.5

![Frequency distribution of noise level range at uninterrupted flow condition](image)
Assessment and Modelling of Noise levels due to Vehicular traffic flow

Average % 2.18 14.54 53.29 28.36 1.63

Figure No.5.6 Variation in Traffic composition at interrupted flow condition

Average % 3.42 14.36 49.08 30.54 1.51

Figure No.5.7 Variation in Traffic composition at uninterrupted flow condition
5.6 Assessment Of Traffic Noise Annoyance

5.6.1 Socioeconomic characteristics at Uninterrupted flow condition

The age, marital status, education, income and occupation of the sample population are evaluated with help of Questionnaire survey. It is observed that, 38 % of the sample ranged in age between 25 and 35 years, 99 % percent were within the working age range 15-55 years. Of the interviewed individuals, 49.5 % were married. The greatest majority however had a graduation 46 % followed by HSC education 25.7 %, followed by SSC 20.6 % and post graduation 7.2 %. The majority of the sample (58.07%) was comprised with an income of Rs.5000 – 15000 and 27.8 % had a monthly income less than Rs. 5000.

5.6.2 Socioeconomic characteristics at Interrupted flow condition

Thirty four percent of the sample ranged in age between 25 and 35 years. Ninety-seven and half percent were within the working age range 15-55 years. Of the interviewed individuals, 57.5% were married. The greatest majority however had a graduation and HSC education, followed by post graduation. The majority of the sample (74.5%) was comprised with an income of Rs.5000 – 15000 and 25.5 % had a monthly income more than Rs. 15000.

5.6.3 Problem of traffic noise at Uninterrupted flow condition

Sample individuals were requested to rank the most important transport related urban problem. The list included noise, air, vision pollution. Noise (62%) and air (38%) pollution were recognized as the most important transport related urban problem. The reasons for noise pollution were evaluated as Horn (56%) followed by Traffic jam (20%), silencer (13%) and Engine (11%). The distribution of annoyance due to vehicle categories are as 60% due to Trucks, followed by 12% due to Bus, 22% due to motorcycle and 6% due to car/minibus. Response to the question “Does traffic noise annoy you?” showed that 73% of sample respondent were annoyed; 17% were not annoyed; and the remaining 10 % stated, “I don’t know”. The period between 12.00 noon to 6 p.m. was identified by 47% the interviewed individuals as the period when traffic noise bothered the most. The period extending from
6 pm to 12 night was the second most disturbed period of the day (32%), followed by 6 am to 12 noon period (20%), with 12 midnight to 6 am being the least disturbed period (1%).

5.6.4 Problem of traffic noise at Interrupted flow condition

Sample individuals were requested to rank the most important transport related urban problem. Noise (72%) and air (23%) pollution were recognized as the most important transport related urban problem. The reasons for noise pollution were evaluated as Horn (40%) followed by Traffic jam (26%), silencer (24%) and Engine (10%). The distribution of annoyance due to vehicle categories are as 45% due to Trucks, followed by 24% due to Bus, 20% due to motorcycle and 11% due to car/minibus. Response to the question "Does traffic noise annoy you?" showed that 89% of sample respondent were annoyed; 07% were not annoyed; and the remaining 4% stated, "I don't know". The period between 6:00 pm to midnight was identified by 33% the interviewed individuals as the period when traffic noise bothered the most. The period extending from 6 am to 12 noon was the second most disturbed period of the day (32%), followed by 12noon to 6 pm period (30%), with 12 midnight to 6 am being the least disturbed period (5%).

5.6.5 Perceived welfare and health impact at Uninterrupted flow condition

The response distribution of the sample population, regarding interference of routine activities by traffic noise is ascertained. Based on the percentage of responses in the two categories of severe interference (extremely and very much), studying, other time and talking on telephone were the activities most interfered with by traffic noise (53.6%, 42.3% & 40.2%) resp. Speaking was fourth (38.1%), followed by relaxing, eating (37.1%), watching T.V. (35.1%) and sleeping (21.6%). Interference with the other two categories of daily activities - sleeping and watching T.V was reported to a lesser extent. The data indicated that at least one person in five reported severe interference with important daily activities.
The potential health impacts of traffic noise on exposure individuals are also investigated. Based on the severely interfered response categories of extremely and very much, 54% of the sample population reported frequent headaches as a result of being exposed of traffic noise. Nervousness was reported by 47%, as extent of exposure to traffic noise, and 51% believed that traffic noise causes hearing damage.

5.6.6 Perceived welfare and health impact at Interrupted flow condition

The response distribution of the sample population, regarding interference of routine activities by traffic noise. Based on the percentage of responses in the two categories of severe interference (extremely and very much), talking on the telephone and speaking were the activities most interfered with by traffic noise (59% & 58.5%) resp. Studying was third (58%), followed by other time (57%), watching T.V. (54%) and relaxing (52.5%). Interference with the other two categories of daily activities – sleeping and eating was reported to a lesser extent. The data indicated that at least one person in four reported severe interference with important daily activities.

The potential health impacts of traffic noise on exposure individuals are also investigated. Based on the severely interfered response categories of extremely and very much. 53% of the sample population reported frequent headaches as a result of being exposed of traffic noise. Nervousness was reported by 58%, as extent of exposure to traffic noise, and 50% believed that traffic noise causes hearing damage.