Evaluation and analysis of traffic noise from the main roads in the Trakya region of Turkey

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Abstract

This study concerns analysis and evaluation of traffic noise in the Trakya region of Turkey. Road traffic noise is one of the most significant sources of noise pollution in this region. Measurements of traffic noise levels in the Trakya region indicated that noise levels in this region were higher than those set by the Turkish Noise Control Regulations. This paper presents the results of the road traffic noise measurements, traffic noise characteristics of the Trakya region, Turkish noise standards and policy and noise mitigation strategies aiming for quiet cities.

1 Introduction

The impact of road traffic noise, which has far-reaching and wide-ranging effects, has increased because of industrialization and urbanization resulting in an increase in noise levels. Thus, road traffic noise has become an issue of immediate concern to many authorities [1]. Traffic noise surveying and analysis was performed along the main roads in urban areas of the Trakya region of Turkey. The Trakya region lies in the northwest of Turkey. There are three provinces, Tekirdağ, Kırklareli and Edirne in the Trakya region. Lüleburgaz Town of Kırklareli and Çorlu and Çerkezköy Towns of Tekirdağ are in the area, where industrialization has developed rapidly. The economy of these towns, until 30 years ago, was agricultural based. Although good transportation facilities, which are E-5 Highway, TEM Motorway, Çorlu Airport, Harbour of Marmara Ereğlisi and railway, are one of the main reasons for industrialization, these are also one of the main reasons for noise pollution. Along with economic growth of
the Trakya region and especially of Lüleburgaz, Çorlu and Çerkezköy, significant changes in these towns have been observed:

- Increasing number of people via migration to search job especially in textile industry,
- Increasing number of vehicles,
- Increasing urbanization such as building of factories and houses for new inhabitants.

The main objectives of this study are analysis and evaluation of traffic noise from roads in the Trakya region. In this case the following subjects were carried out:

- The results of the road traffic noise measurements,
- Traffic noise characteristics of the Trakya region,
- Turkish noise standards and policy,
- Noise mitigation strategies aiming quiet cities.

In countries with social and economical problems, like Turkey, urban noise has not been receiving enough importance. Noise pollution and its influence on life quality of human beings must be given enough attention. The goal of this study was to show the noise level measurements carried out different zones of the towns of Çorlu, Çerkezköy and Lüleburgaz. The objectives of noise management are to collect data for noise exposure levels and to promote noise assessment and to maintain noise levels that protect human health.

2 Methodology

Noise measurements were performed between 6:00 am and 12:00 pm for the years of 2001 and 2002 in the certain locations, which can characterize the towns. There were 15 different locations in each of surveyed towns. In order to compare noise levels of residential areas, town centres and industrial areas, locations from residential, industrial areas and town centres were selected. All measurements were carried out during working days (between Monday and Friday) and under ideal meteorological conditions without rain and wind and temperature of sites varied from 10 to 20°C at the time of measurements. Simultaneous measurements were made at the edge of roads and in front of houses where there are no intervening structures. Measurements were taken by CEL-269 Digital Integrated Sound Level Meter. It was calibrated with its own calibrator before each of working days. The equivalent sound level (LAeq) values and maximum sound level (LMax) were recorded for 5 minutes.

3 Turkish noise standards and policy

The Noise Control Regulation, which came into operation on 11 December 1986, addresses the legal arrangement about noise control. According to regulation, main criterion for traffic noise is selected from 35 dBA to 45 dBA. Regulation
defines four zones and noise levels, based on this criterion, in each of these zones for different periods (Table 1) [2].

Table 1: Noise levels in different zones.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Zone Description</th>
<th>Main Criterion</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Out of residential areas (far away from traffic)</td>
<td>0</td>
</tr>
<tr>
<td>II</td>
<td>Residential suburbs</td>
<td>+5</td>
</tr>
<tr>
<td></td>
<td>Residential areas (100 m away from traffic flow)</td>
<td>+10</td>
</tr>
<tr>
<td></td>
<td>Residential areas, main roads, commercial areas (60 m away from traffic flow)</td>
<td>+15</td>
</tr>
<tr>
<td>III</td>
<td>Residential areas in the city centres, main roads, commercial areas (20 m away from traffic flow)</td>
<td>+20</td>
</tr>
<tr>
<td>IV</td>
<td>Industrial zone and main roads for heavy vehicles and busses</td>
<td>+25</td>
</tr>
</tbody>
</table>

4 Traffic and noise characteristics of the surveyed towns

Noise problems are caused by significant increases in volumes of traffic and population.

4.1 Significant population increase

The population density of Çerkezköy, Çorlu and Lüleburgaz Towns are about 254, 199 and 199 people/km², respectively, while that is 88 people/km² for Turkey [3]. The population increase in Turkey shows an annual growth rate of 1.83%. The population of these towns grew rapidly in last 15 years and the population increase was accelerated by annual growth rate of 6-7% [3]. This increase is especially because of migration of people from other regions of Turkey but not the reason of birth rate. Birth rate increase is too low in this region, which is compared with east, and southeast regions of Turkey. Due to this population increase, there are traffic jams and traffic noise problems especially in town centres.

4.2 Traffic characteristics of the towns

Traffic congestion in this region is due to daily trips of vehicles registered in other provinces, especially in İstanbul, and increasing numbers of vehicles registered in each of towns.
4.2.1 Significant increase in daily trips
There is a significant increase in daily trips. These towns are not far away from İstanbul, which is one of the most developed provinces in Turkey. It only takes 100 km from Çerkezköy and Çorlu, 150 km from Lüleburgaz. Administrative offices (sales, general directory offices) of factories and commercial activities are in İstanbul. People from general offices of factories and sales persons, from İstanbul, visit factories daily with their cars.

4.2.2 Significant increase of vehicle numbers
Vehicles, registered in these towns, have increased annually by about 10% [4]. Most of vehicles in these towns belong to factories. Old cars emit a greater noise than newer vehicles. In 2004, Turkish Government supported to buy new cars and cars aged 20 and upper were described as scrap. It was supported by Government to buy new cars and when new cars were bought, reductions were made in prices of cars for these scraps.

4.2.3 Contribution of heavy vehicles
Due to rapid industrialization, numbers of heavy vehicles such as lorries, busses and long vehicles, have been increasing for 15 years.

4.3 Driver behaviour
Illegal behaviour of drivers has led to traffic and traffic noise problems due to extreme horn use with and without reason, driving with high speed and carelessly.

4.4 Street patterns
Streets are too narrow and unsuitable for congested traffic in town centres. Parking is also a major problem in town centres. New planned residential areas include large roads and footpaths for pedestrians.

4.5 Relations between pedestrians and traffic
There is shortage of footpaths for pedestrians in town centres. Most of footpaths in town centres are narrow and crowded so pedestrians jaywalk around traffic. Drivers use their horns to avoid and warn pedestrians.

5 Results
In this section of this paper, results of measurements in surveyed towns were given.

5.1 Results in Lüleburgaz Town
In Lüleburgaz, 15 different measurement locations, covering residential areas and city centre were selected. These locations were numbered from 1 to 15 as
given in Table 2. Figure 3 shows the results of measurements in these locations. Results of measurements of traffic noise levels in each of selected locations were higher than those set by the Turkish Noise Control Regulations.

Table 2: Noise measurement locations.

<table>
<thead>
<tr>
<th>Location Number</th>
<th>Towns</th>
<th>Lüleburgaz</th>
<th>Çorlu</th>
<th>Çerkezköy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>İstanbul Str.</td>
<td>İstanbul Str. (Murat Hüdavendigar Str.)</td>
<td>Road Between Çorlu and Çerkezköy</td>
<td>Train Station</td>
</tr>
<tr>
<td>2</td>
<td>Front of Officer’s Clup (İstasyon Str.)</td>
<td>Front of Officer’s Clup (İstasyon Str.)</td>
<td>Sculpture Square</td>
<td>Bus Station Junction</td>
</tr>
<tr>
<td>3</td>
<td>200 m away from Yaman Hotel (İstanbul Str.)</td>
<td>200 m away from Yaman Hotel (İstanbul Str.)</td>
<td>Bus Station in front of post office</td>
<td>Municipality Square (Atatürk Sculpture)</td>
</tr>
<tr>
<td>4</td>
<td>Bazaar (Front of İş Bank)</td>
<td>Bazaar (Front of İş Bank)</td>
<td>Atatürk Str. (İstanbul-Tekirdağ Road)</td>
<td>Narin Factory Junction</td>
</tr>
<tr>
<td>5</td>
<td>İstanbul Str.</td>
<td>İstanbul Str. (Murat Hüdavendigar Str.)</td>
<td>Orion Junction</td>
<td>E-5 Road Between İstanbul and Çerkezköy</td>
</tr>
<tr>
<td>6</td>
<td>Front of Post Office (Edirne Str.)</td>
<td>Front of Post Office (Edirne Str.)</td>
<td>Atatürk Boulevard</td>
<td>Fevzi Paşa Quarter</td>
</tr>
<tr>
<td>7</td>
<td>Çeşme Square (Turgutbey Str.)</td>
<td>Çeşme Square (Turgutbey Str.)</td>
<td>Havuzlar District (Amusement Park)</td>
<td>Emlak Konutları</td>
</tr>
<tr>
<td>8</td>
<td>Front of Telekom (Edirne Str.)</td>
<td>Front of Telekom (Edirne Str.)</td>
<td>Bus Terminal</td>
<td>Fatih Boulevard</td>
</tr>
<tr>
<td>9</td>
<td>Side of Kadı Mosque (İnöne Str.)</td>
<td>Side of Kadı Mosque (İnöne Str.)</td>
<td>Emlak Konutlar (Station)</td>
<td>11th Street</td>
</tr>
<tr>
<td>10</td>
<td>Turgutbey Str.</td>
<td>Turgutbey Str. (İstasyon Str.)</td>
<td>Mehmet Akif Ersoy High School Junction</td>
<td>Atatürk Str.</td>
</tr>
<tr>
<td>11</td>
<td>Front of Lüleburgaz Primary School (İstasyon Str.)</td>
<td>Front of Lüleburgaz Primary School (İstasyon Str.)</td>
<td>Kıvanç Yapı Koop.</td>
<td>8th Street</td>
</tr>
<tr>
<td>12</td>
<td>Altyol</td>
<td>Altyol</td>
<td>Sağlık Quarter 1st Bridge</td>
<td>9th Street</td>
</tr>
<tr>
<td>13</td>
<td>Edirne Str.</td>
<td>Edirne Str. (İstasyon Str.)</td>
<td>Beginning of Tabakhane Str.</td>
<td>5th Street</td>
</tr>
<tr>
<td>14</td>
<td>Fatih Str.</td>
<td>Fatih Str. (İstasyon Str.)</td>
<td>North Str.</td>
<td>Karamağac Road</td>
</tr>
<tr>
<td>15</td>
<td>Between Fire station and Terminal (İstasyon Str.)</td>
<td>Between Fire station and Terminal (İstasyon Str.)</td>
<td>Bridge Junction</td>
<td>7th Street</td>
</tr>
</tbody>
</table>
Figure 1: Noise levels in Lüleburgaz Town.

Figure 2: Noise levels in Çorlu Town.

Figure 3: Noise levels in Çerkezköy Town.
5.2 Results in Çorlu Town

In Çorlu, 15 different measurement locations, covering residential and industrial areas and city centre were selected. These locations were numbered from 1 to 15 as given in Table 2. Locations numbered from 13 to 15 were selected from industrial zone (Organized Industrial Zone). Figure 1 shows the results of measurements in these locations. Results of measurements of traffic noise levels in each of selected locations were higher than those set by the Turkish Noise Control Regulations.

5.3 Results in Çerkezköy Town

In Çerkezköy, 15 different measurement locations, covering residential and industrial areas and city centre were selected. These locations were numbered from 1 to 15 as given in Table 2. Locations numbered from 8 to 15 were selected from industrial zone. Figure 2 shows the results of measurements in these locations. Results of measurements of traffic noise levels in each of selected locations were higher than those set by the Turkish Noise Control Regulations.

6 Conclusions

The traffic noise situation in the big cities in industrialized countries shows great similarities. Approximately 20% of the EU population is exposed to outdoor noise levels exceeding 65 dB (equivalent-weighted daytime levels) and a little more than 40% of are exposed to levels between 55 and 65 dBA [5]. Taking all exposure to transportation noise together about half of the European citizens are estimated to live in zones that do not ensure acoustic comfort to residents. More than 30% are estimated to be exposed at night to equivalent sound pressure levels exceeding 55 dBA, which are disturbing to sleep [6]. The noise pollution problem is particularly severe in cities of developing countries and caused mainly by traffic. Data alongside densely travelled roads were found to have equivalent sound pressure levels for 24 hours of 75 to 80 dBA. Our results conform to views discussed in these papers. Measurements of roads of traffic noise levels in these towns of the Trakya region indicate that noise levels in these towns are higher than those set by Turkish noise standards and policy to protect public health and welfare.

In order to solve traffic noise problems in the Trakya region, we suggest that to make replanning of urbanization, to construct new traffic arteries, to control of traffic and traffic volume, to improve road surfaces, to build noise barriers and to plant trees and grass.

References

[2] Turkish Noise Control Regulation