Data Article

Dataset on the road traffic noise measurements in the municipality of Thessaloniki, Greece

Paraskevi Begou, Pavlos Kassomenos, Apostolos Kelessis

Laboratory of Meteorology, Department of Physics, University of Ioannina, GR-45110, Ioannina, Greece
Environmental Department, Municipality of Thessaloniki, Paparigopoulou 7, Thessaloniki 54630, Greece

Article info

Article history:
Received 11 November 2019
Received in revised form 22 January 2020
Accepted 23 January 2020
Available online 31 January 2020

Keywords:
Noise pollution
Road traffic noise
Leq
Lden
Lnight

Abstract

The continuous monitoring of environmental noise levels is deemed necessary, such in the strategic noise mapping or in the cohort studies. The environmental noise levels can be measured and analysed with the aid of various methods. In this article presents the method recommended by the European Union (EU). The data contain the road traffic noise level measurements in the Greater Thessaloniki area, Greece. The Leq noise measurements carried out at two different locations, the Urban Highway-Hot Spot area and the Residential area, for a 3 year measurement period. Also, the analysis was based on the environmental noise indicators Lday, Lden, Levening, Lnight.

© 2020 The Authors. Published by Elsevier Inc. This is an open access article under the CC BY license (http://creativecommons.org/licenses/by/4.0/).

1. Data description

The environmental noise pollution is one of the major public issues affecting the inhabitants in the Greater Thessaloniki Area, in Greece.

The Environmental Department of Municipality of Thessaloniki performed systematic measurements of the urban road traffic noise levels. These measurements, mainly, were performed in commercial or residential areas in busy roads with high traffic load. The dataset from these recordings is provided as a supplementary material in the online version of the article.
The data presented in this article contain the road traffic measurements at two different locations in the urban area of Thessaloniki. The choice of these two areas arose from the fact that they experience high volumes of road traffic. The locations of the measurement points are presented in Fig. 1. The measurements were performed in two investigated areas, at Egnatia street and 25th Martiou street. Therefore, Egnatia and 25th Martiou streets named Highway-Hot Spot and Residential area, respectively. The Highway-Hot Spot area is the most influencing road in the city with the highest traffic load and the maximum vehicle fleet. Similarly, the Residential area represents one of the most noisy streets of the city with wide range of urban conditions.

Tables 1 and 2 summarizes the noise metrics mentioned above. The mean hourly values of the road traffic noise levels, which presented in Table 1, were collected in the Urban Highway-Hot Spot area from the annual measurements. Similarly, Table 2 presents the same values for the Residential area. The \( L_{\text{min}} \) and \( L_{\text{max}} \) values presented in Table 3. These values determined the hourly recordings of \( L_{\text{eq,T}} \), which calculated during the period of noise measurements.

From Fig. 2, we can see the road traffic noise indicators, \( L_{\text{day}} \), \( L_{\text{den}} \), \( L_{\text{evening}} \) and \( L_{\text{night}} \) for the two measurement locations for a 3 year time period. The details from the aforementioned road traffic noise measurements are discussed in Begou et al. (2020). In the same work the relation of road traffic with the Greek financial crisis is investigated. Also, they estimated the prevalence of cardiovascular diseases due to exposure to road traffic noise is estimated.
2. Experimental design, equipment and analyses

2.1. Noise exposure assessment

The road traffic noise measurements are carried out using the recommended method, in accordance to the requirements of the EU Environmental Directive 2002/49/EC.

Thus the measurements were performed with a Noise Level Analyzer, type Solo Master (01dB-Stell-MVI Technologies Group, France) and the outdoor microphone was used is MCE 212 (class 1).

The noise level analyzer accuracy conforms to IEC 61672-1 international standard, which represents sound level meters suitable for general field applications. The monitoring station used in combination with pre-amplifier, filter set and weighting network.

Also, a computer was used for initial setting up and checking the process of the recording metrics. The computer is equipped with the software responsible to collect and analyse the measurement data and presents the measurement results. Also, the instruments were equipped with noise statistical analyzers.

In order to monitor the credibility of the measurements through the duration of the recordings of the acoustic environment, the instruments were calibrated with an acoustical calibrator.

In accordance with the European and Greek legislation (Directive 2002/49/EC) the noise level analyzer was mounted on a tripod at a height of 4.0 ± 0.2 m above the ground and at a 2 m minimum resolution on each building facade.

Necessarily, a distance was taken between the sound level meter and the surrounding obstacles. The reason is that these obstacles, which include the building walls or building facades, may intensify or reduce the received noise level (Kelessis et al., 2005).

Furthermore, for the weather protection, the microphone is covered by a windscreen. Thus, the monitoring station can be left unattended for a long period without being damaged by the weather conditions such as rain, snow or wind.

In Fig. 3 the noise level analyzer and the microphone used for the measurement procedure are presented.
The wide noise measurement range allows the instrument to be used for a diverse range of environmental noise investigations. In the environmental analysis, the sound levels fluctuate with time and thus the equivalent noise level (LA_{eq,T}) must be measured. The sound level meter records continuous steady noise levels during a 24-h period and automatically calculates the equivalent noise levels (LA_{eq,T}), according to Equation (1).

\[ L_{\text{Aeq,T}} = 10 \log_{10} \int_0^T \frac{P_A(t)}{P_0^2} \, dt \]  

The LA_{eq,T} represents the sound pressure level in decibels averaged over a certain period of the time (T) in terms of energy, with frequency ranges, being measured according to the sensitivity scale A of the human ear. The biophysical quantity A-weighting sound level, which expressed in A-weighted decibels (dB(A)), is the type of scale introduced to account for the subjective nature of noise exposure. Therefore, the sound pressure levels rates at different frequencies in a way comparable to that of the human hearing (Passchier-Vermeer and Passchier, 2000).

From the LA_{eq,T} measurements, we calculated the L_{min} and L_{max} values. The L_{min} and L_{max} represents the maximum and minimum values measured over the one year period of the road traffic noise measurements.

Moreover, according to the Directive 2002/49/EC the member states apply the noise indicators L_{den} and L_{night} for the assessment of harmful effects on human health and wellbeing.

Hence, we calculated the L_{day}, L_{evening}, L_{den} and L_{night} environmental noise indices.

---

**Table 1**
The Leq (dB(A)) road traffic noise measurements with standard deviation (SD) values for the Urban Highway-Hot spot area.

| Measurement Period          | Measurement Period          | Measurement Period          |
|-----------------------------|-----------------------------|-----------------------------|
| 1/1/2004-31/12/2004         | 1/1/2005-31/12/2005         | 1/1/2006-31/12/2006         |
| Hour (EET)* L_{eq} (dB(A))  | Hour (EET)* L_{eq} (dB(A))  | Hour (EET)* L_{eq} (dB(A))  |
| SD (dB(A))                  | SD (dB(A))                  | SD (dB(A))                  |
| 0:00 70.48 (1.99)           | 0:00 70.31 (1.38)           | 0:00 69.62 (1.40)           |
| 1:00 69.70 (1.75)           | 1:00 69.48 (1.41)           | 1:00 68.76 (1.59)           |
| 2:00 68.69 (1.78)           | 2:00 68.59 (1.63)           | 2:00 67.78 (1.82)           |
| 3:00 68.14 (1.48)           | 3:00 68.11 (1.91)           | 3:00 66.86 (1.84)           |
| 4:00 69.28 (1.10)           | 4:00 68.89 (1.44)           | 4:00 67.97 (1.46)           |
| 5:00 71.38 (1.07)           | 5:00 70.81 (1.20)           | 5:00 70.08 (1.38)           |
| 6:00 72.16 (1.01)           | 6:00 71.71 (1.00)           | 6:00 70.96 (1.20)           |
| 7:00 72.01 (0.90)           | 7:00 71.78 (0.96)           | 7:00 71.20 (1.61)           |
| 8:00 71.88 (0.90)           | 8:00 71.69 (0.90)           | 8:00 71.09 (1.25)           |
| 9:00 71.88 (0.90)           | 9:00 71.80 (1.23)           | 9:00 71.16 (1.61)           |
| 10:00 71.93 (1.01)          | 10:00 71.81 (1.29)          | 10:00 71.17 (1.43)          |
| 11:00 72.10 (0.91)          | 11:00 71.82 (0.95)          | 11:00 71.27 (1.25)          |
| 12:00 72.16 (0.92)          | 12:00 71.89 (0.90)          | 12:00 71.38 (1.28)          |
| 13:00 72.11 (0.86)          | 13:00 71.98 (0.94)          | 13:00 71.52 (1.47)          |
| 14:00 72.14 (0.81)          | 14:00 72.01 (0.93)          | 14:00 71.41 (1.17)          |
| 15:00 72.20 (0.84)          | 15:00 71.95 (0.87)          | 15:00 71.38 (1.06)          |
| 16:00 72.27 (0.85)          | 16:00 72.04 (0.97)          | 16:00 71.44 (1.15)          |
| 17:00 72.19 (0.90)          | 17:00 71.97 (0.94)          | 17:00 71.36 (1.15)          |
| 18:00 72.13 (1.13)          | 18:00 71.84 (0.86)          | 18:00 71.19 (1.17)          |
| 19:00 72.11 (1.09)          | 19:00 71.91 (0.96)          | 19:00 71.19 (1.12)          |
| 20:00 72.09 (0.90)          | 20:00 71.88 (0.94)          | 20:00 71.19 (1.14)          |
| 21:00 72.13 (1.21)          | 21:00 71.82 (0.92)          | 21:00 71.20 (1.29)          |
| 22:00 71.86 (1.16)          | 22:00 71.52 (0.95)          | 22:00 70.89 (1.26)          |
| 23:00 71.33 (1.82)          | 23:00 71.05 (1.29)          | 23:00 70.35 (1.32)          |

*(EET): Eastern European Time, UTC +02:00 time zone and UTC +03:00 during summer.
In accordance with the Greek legislation the national limit values for the transportation noise are 70 dB and 60 dB, respectively, for the $L_{\text{den}}$ and $L_{\text{night}}$ environmental noise indicators.

From the measurements of equivalent noise levels we estimate the A-weighted day-evening-night equivalent sound level $L_{\text{den}}$ in decibels (dB), calculated for the 24-h period of the day with the following equation:

$$L_{\text{den}} = 10 \times \log \frac{1}{24} \left( 12 \times 10^{\frac{\text{day}}{10}} + 4 \times 10^{\frac{\text{even}}{10}} + 8 \times 10^{\frac{\text{night}}{10}} \right)$$

in which:

- $L_{\text{day}}$ indicator is the A-weighted long-term average sound level, determined for 12 h of the day between 07.00 to 19.00 local time.

### Table 2
The $L_{\text{eq}}$ (dB(A)) road traffic noise measurements with standard deviation (SD) values for the Residential area.

| Measurement Period | Measurement Period | Measurement Period |
|--------------------|--------------------|--------------------|
| 1/1/2006-31/12/2006 | 1/1/2007-31/12/2007 | 1/1/2008-31/12/2008 |
| Hour (EET)* | $L_{\text{eq}}$ (dB(A)) | SD (dB(A)) | Hour (EET)* | $L_{\text{eq}}$ (dB(A)) | SD (dB(A)) | Hour (EET)* | $L_{\text{eq}}$ (dB(A)) | SD (dB(A)) |
| 0:00 | 65.60 | 1.56 | 0:00 | 64.49 | 2.55 | 0:00 | 64.74 | 2.45 |
| 1:00 | 65.34 | 3.19 | 1:00 | 63.64 | 2.77 | 1:00 | 63.77 | 2.19 |
| 2:00 | 63.74 | 2.56 | 2:00 | 62.52 | 2.31 | 2:00 | 62.61 | 2.38 |
| 3:00 | 62.64 | 1.86 | 3:00 | 62.44 | 1.84 | 3:00 | 61.70 | 2.56 |
| 4:00 | 62.71 | 1.48 | 4:00 | 63.52 | 2.49 | 4:00 | 61.76 | 2.41 |
| 5:00 | 64.32 | 2.03 | 5:00 | 65.02 | 2.24 | 5:00 | 63.81 | 2.15 |
| 6:00 | 65.88 | 1.35 | 6:00 | 66.11 | 2.04 | 6:00 | 65.15 | 2.02 |
| 7:00 | 66.97 | 1.95 | 7:00 | 66.78 | 2.26 | 7:00 | 66.08 | 2.08 |
| 8:00 | 66.88 | 1.34 | 8:00 | 66.76 | 1.80 | 8:00 | 66.45 | 2.29 |
| 9:00 | 67.71 | 2.24 | 9:00 | 67.07 | 1.93 | 9:00 | 66.80 | 2.48 |
| 10:00 | 68.15 | 2.59 | 10:00 | 67.34 | 2.21 | 10:00 | 66.92 | 2.31 |
| 11:00 | 67.76 | 2.12 | 11:00 | 67.99 | 2.90 | 11:00 | 67.38 | 2.86 |
| 12:00 | 66.14 | 3.37 | 12:00 | 67.31 | 1.79 | 12:00 | 67.07 | 2.37 |
| 13:00 | 68.33 | 2.74 | 13:00 | 67.57 | 2.58 | 13:00 | 67.25 | 2.46 |
| 14:00 | 67.74 | 2.30 | 14:00 | 67.35 | 2.53 | 14:00 | 66.94 | 2.39 |
| 15:00 | 67.14 | 1.11 | 15:00 | 67.26 | 2.42 | 15:00 | 66.85 | 2.52 |
| 16:00 | 67.40 | 1.88 | 16:00 | 67.00 | 2.27 | 16:00 | 66.76 | 2.29 |
| 17:00 | 67.25 | 1.42 | 17:00 | 66.74 | 1.98 | 17:00 | 66.21 | 3.22 |
| 18:00 | 67.08 | 2.21 | 18:00 | 66.95 | 2.46 | 18:00 | 66.38 | 2.36 |
| 19:00 | 66.89 | 2.11 | 19:00 | 66.93 | 2.53 | 19:00 | 66.50 | 2.41 |
| 20:00 | 67.13 | 2.48 | 20:00 | 66.88 | 2.48 | 20:00 | 66.50 | 2.31 |
| 21:00 | 67.15 | 2.43 | 21:00 | 66.37 | 1.79 | 21:00 | 66.40 | 2.39 |
| 22:00 | 66.75 | 1.93 | 22:00 | 65.87 | 2.13 | 22:00 | 66.57 | 2.94 |
| 23:00 | 66.30 | 1.52 | 23:00 | 65.26 | 2.19 | 23:00 | 65.71 | 2.47 |

*(EET): Eastern European Time, UTC+02:00 time zone and UTC+03:00 during summer.

In accordance with the Greek legislation the national limit values for the transportation noise are 70 dB and 60 dB, respectively, for the $L_{\text{den}}$ and $L_{\text{night}}$ environmental noise indicators.

From the measurements of equivalent noise levels we estimate the A-weighted day-evening-night equivalent sound level $L_{\text{den}}$ in decibels (dB), calculated for the 24-h period of the day with the following equation:

$$L_{\text{den}} = 10 \times \log \frac{1}{24} \left( 12 \times 10^{\frac{\text{day}}{10}} + 4 \times 10^{\frac{\text{even}}{10}} + 8 \times 10^{\frac{\text{night}}{10}} \right)$$

in which:

- $L_{\text{day}}$ indicator is the A-weighted long-term average sound level, determined for 12 h of the day between 07.00 to 19.00 local time.

### Table 3
Minimum ($L_{\text{min}}$) and maximum ($L_{\text{max}}$) noise levels at the measurement locations.

| Urban Highway-Hot Spot | $L_{\text{min}}$ (dB(A)) | Date | Hour (EET)* | $L_{\text{max}}$ (dB(A)) | Date | Hour (EET)* |
|------------------------|--------------------------|------|------------|--------------------------|------|------------|
| 2004                   | 64.90                    | 27 July 2004 | 2:00 | 89.20 | 05 July 2004 | 00:00 |
| 2005                   | 63.90                    | 15 August 2005 | 2:00 | 86.20 | 11 May 2005 | 10:00 |
| 2006                   | 63.20                    | 15 August 2006 | 3:00 | 86.00 | 07 September 2006 | 7:00 |

| Residential Area | $L_{\text{min}}$ (dB(A)) | Date | Hour (EET)* | $L_{\text{max}}$ (dB(A)) | Date | Hour (EET)* |
|------------------|--------------------------|------|------------|--------------------------|------|------------|
| 2006             | 58.90                    | 27 September 2006 | 3:00 | 85.00 | 04 November 2006 | 12:00 |
| 2007             | 58.00                    | 21 June 2007 | 3:00 | 82.90 | 28 November 2007 | 14:00 |
| 2008             | 56.90                    | 30 June 2008 | 3:00 | 81.50 | 17 May 2008 | 11:00 |

*(EET): Eastern European Time, UTC+02:00 time zone and UTC+03:00 during summer.
Levening indicator is the A-weighted long-term average sound level, determined for the evening during 4 h between 19.00 to 23.00 local time.

Lnight indicator is the A-weighted long-term average sound level, determined for 8 h during the night between 23.00 to 07.00 local time.

The 10 dBs penalty in the Equation (2) was added to the sound levels between 22.00 and 07.00, while the 5 dBs penalty was added to the levels between 19.00 and 22.00 to reflect individual's sensitivity to noise pollution during the night and the evening.

Therefore, we calculated the noise indicators Lden and Lnight from the available noise measurements using Equation (2). The noise values for the indicators Lday, Levening, and Lnight, as calculated in the Equation (2), collected from the 24-h measurements adjust for the mean values for the time period 07.00 to 19.00, 19.00 to 23.00 and 23.00 to 07.00, respectively.
Acknowledgements

We would like to thank Municipality of Thessaloniki, Department of Environment, which offered the noise data.

Conflict of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.dib.2020.105214.