

NOISE POLLUTION GENERATED BY RING ROADS

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ABSTRACT

This document shows the results of a study on noise levels on roads with high traffic density. The study has analysed noise pollution on ring roads, approach roads and inner-city streets in the city of León (Spain).

The data obtained for the different L_{10} , L_{50} , L_{90} , Leq and L_{max} are particularly significant, as they sometimes show levels of almost 100 dBA in L_{max} during daytime, and levels within the 65-70 dBA range in Leq . The measured values show strong similarities in noise pollution levels in ring roads and inner-city roads, which clearly indicates the urgent need to develop ring roads around cities (or to complete those which are currently being built).

INTRODUCTION

The building of ring roads in centres of population has become an increasingly necessary requirement in modern cities, as those which do not have any ring road structure around them (either because there are no plans to build one or because the projected ring road has not been finished yet) have been forced to endure high levels of traffic in their streets. The lack of a "protecting" ring road around the city has resulted in a great number of vehicles, some of them high-tonnage lorries, being forced to drive through inner-city streets, producing massive disruptions to local traffic and, as a consequence, high levels of noise pollution.

In the case of the subject of this study (León, approximate population: 150,000) the completion of the much required ring road around the main centre of population has already suffered several major delays. At the moment, only the so-called "East Way" of the ring road has been developed, which represents less than half of the total project. The remaining part of the ring road is currently under construction, although it does not seem the project will be completed in the short term.

The Acoustics Laboratory at the University of León has recently handed to the city council the updated acoustic map of the city, together with the results of the study on noise pollution as a result of the absence of a ring road around the city, which will be briefly discussed below.

METHODOLOGY

Noise measurements for this study have been made in two different types of roads: on the one hand, the "East Way" of the ring road currently under construction and, on the other, two inner-city streets: Avda. Fernández Ladreda and Avda. de Portugal. For the purposes of this study, these roads have been divided into a series of homogeneous sections. All three roads show similar characteristics: two-way streets, with a low central reservation and two or three lanes available for driving.

Representation and Randomisation.

As previously stated, the roads which have been the subject of this study have been divided into a group of sections according to their total length and the disposition of traffic lights. A series of representative points in each section was chosen for measuring. Thus, the acoustic conditions of every road would be determined as the average of all values measured at each of those points.

The distribution of sections and their corresponding measurement points was set as follows:

- East Way: 6 sections, denominated as RON-I, RON-II... RON-VI (15 measurement points).
- Inner-city streets:
 - Avda. Fernández Ladreda: 2 sections, LAD-I and LAD-II (7 measurement points).
 - Avda. de Portugal: 2 sections, POR-I and POR-II (3 measurement points)

Measurements were carried out as follows:

- Daytime: from 8am to 10pm. Daytime was divided between a MORNING and EVENING period of equal length. Each of these periods was further subdivided into 3 time intervals:
 - MORNING: 8am to 10am - 10am to 1pm - 1pm to 3pm.
 - EVENING: 3pm to 5 pm - 5pm to 8 pm - 8pm to 10 pm.
- Nighttime: from 10pm to 8 am. Nighttime was also divided into three time intervals: 10pm to 12pm – 12pm to 6 am - 6am to 8am

Noise levels were measured in 10-minute intervals during daytime and 5-minute intervals during nighttime. As a result, each point had a 75-minute total measurement time.

In order to guarantee maximum representation, the following conditions were being observed:

- Each point could not be measured more than once in the same day.
- Measurements could be made at different points of the same street or section, so long as they were taken at a different time period.
- Whenever possible, measurements from one street were being taken on alternate sides of the pavement.

Measurement parameters.

From an acoustic point of view, each measurement point was determined by its Level of Equivalent Noise (Leq), its corresponding L_{40} , L_{50} and L_{90} percentile levels and its Lmax. All these values were expressed as dBAs.

Urban development conditions were also being registered at each measurement point. They comprised aspects such as type of road, road surface, height and width, whether it was a one-way or two-way street, etc. Other parameters such as frequency in traffic per type of vehicle were also taken into account.

Measurement equipment.

The equipment used was the following:

- Sound level meter, Brüel&Kjaer, 2231.
- Acoustic calibrator, 4230.
- Sound level meter CEL 393
- Sound calibrator CEL 177

All instruments were calibrated before and after each measurement was made. All necessary precautions were adopted as regards distance, tripod height, climatic conditions or any other determining factors that could greatly alter the values obtained during the measuring process.

FINDINGS

Apart from the data obtained during the measuring process, this document also includes charts depicting the evolution in the acoustic levels of every road studied, both on an individual and comparative basis. However, the following aspects can be highlighted:

- Values obtained for the different parameters show almost constant levels of noise pollution during daytime, from 8am to 10pm. Values for the 10pm-12pm and 6am-8am periods also show fairly constant levels, albeit lower than those measured during peak periods. However, noise levels for the 12pm-6am period are clearly lower than those registered at any other time of the day.
- Traffic density is the major cause behind differences in noise levels. If we take the case of the East Way, for example, whilst traffic density during daytime reaches levels between 1600-2000 vehicles/hour (average of measurements in different sections), during the 12pm-6am period traffic density decreases to the 100-150 vehicles/hour range.
- Values measured for the different parameters are substantially similar in all roads throughout the day, except in the case of the L_{90} , where higher figures have been measured in the case of inner-city streets: final results show a 5dBA difference between Avda. Portugal and Avda. Fdez. Ladreda, and yet another 5 dBA jump between the latter and the East Way. A possible explanation for this can be found in the inner-city character of the two first roads, which means that noise levels derived from the normal activity of a city add up to the noise pollution derived from traffic.
- Brief summary of specific data: the L_{max} was measured at 90-100 dBA range during the hours of very dense traffic and 80 dBA for the 12am-6am period. L_{10} figures do not exceed 80 dBA at peak times, whilst falling to the 75 dBA mark in periods of least dense traffic.
- However, data obtained for the L_{eq} and L_{90} are probably the most significant. The L_{eq} has been measured at around the 75 dBA mark during daytime, and between 65-70 dBA during nighttime. As regards the L_{90} , values for both inner-city streets are situated between 65 and 70 dBA during daytime, and between 50 and 60 dBA during nighttime.

CONCLUSIONS

The results of this study clearly show that the absence of a completed ring road structure around the city of León has resulted in a very serious noise pollution problem, as a great number of vehicles are being forced to drive through the city, substantially increasing noise levels.

This is a very serious issue as two inner-city streets, which should normally deal exclusively with traffic directed towards the city itself, are being transformed into transition carriageways, where noise pollution from traffic (very intense and with a high number of high-tonnage vehicles) is added to the noise derived from the usual activity of people living and working in the city.

Therefore, it is strongly advised that the construction of the ring road around the city is completed in the shortest possible time, a recommendation which can be applied to any other cities under similar circumstances.

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