



**Acoustics'08
Paris**
June 29-July 4, 2008

www.acoustics08-paris.org

Definition of traffic scenarios, application on a practise case of the criteria followed by the guide of good practises for elaboration of strategic traffic noise maps in urban routes

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Abstract

Configuration of noisy environment in towns mostly depends on characterization of traffic noise in urban routes. Nevertheless, frequently there are lacks of information when it is a question of having data from the whole urban area.

To solve these lacks the above-mentioned guide (WG-AEN 002.2006) proposes some default values for an approach for this characterization which can turn out to be very generalists in practical applications.

Through the presentation of these criteria applied to two practical cases, this paper proposes a tool necessary to adjust real traffic characterization to the elaboration of noise maps and definition of an Action Plan. The analyzed variables are: AVT, % of heavy vehicles, time distribution and speed considering, for this last factor, the lacks shown by the interim method and the applicable supposes based upon the state of the art.

As a conclusion, this paper proposes the use of data corresponding to official traffic information or based on counts, when possible. If this kind of data is not available it is recommended to follow the Good Practise Guide. But instead of taking into account the absolute default values, the relationship between the different roads types should be used, in order to characterize the traffic distribution in the city for noise mapping.

Introduction

Directive 2002/49/EC requires the development of Strategic Noise Maps focusing on the analysis of the following noise sources: roads, railways, airports and industry.

One of the main aims in the elaboration of these maps in urban agglomerations is the assessment of noise pollution from a global perspective, in order to identify priority areas for action plans and also “quite areas”.

The outcome of these maps reveals that road traffic constitutes the primary source in the configuration of urban areas soundscape.

This fact shows up that appropriate road traffic baseline information is required, based on the compromise between the need for data accuracy, and the effort invested in its collection and treatment.

Assessment of the most important roads in the urban area is often the preferred option in the elaboration of noise maps. However, in the two case studies discussed in this paper, noise mapping includes consideration of all kind of roads within the agglomeration.

This analysis may exceed the scope of a Strategic Noise Map but it allows reaching a double objective:

- On one hand, to create a database of traffic and noise emissions for all roads in the urban area- a) providing regular updates on the map, b) offering data for other non-acoustic analysis, c) allowing the implementation of more accurate data as soon as it becomes available.
- On the other hand, to analyse the acoustic advantage of roads with lower speed or AVT in urban areas and identify those areas that could be potentially declared as “quite” in consideration of their low noise levels.

When it comes to characterize the acoustic power of roads, several parameters must be considered: AVT, speed, percentage of heavy vehicles, type and condition of road surface, slope, traffic regime, etc.

However, in the elaboration of the study cases Strategic Maps, taking into account their global objective, only three of these parameters, have been considered: AVT, speed and percentage of heavy vehicles.

Thus, as a first approach to the agglomeration acoustic situation, it has been estimated that traffic data used in the study, should not incur in errors which involve more than 3dBA deviation in the roads noise emissions.

Considering this premise, the degree of precision required is as follows:

- The AVT data is not half or twice the actual.
- The percentage of heavy proposed does not differ by more than 20% compared to the actual. (i.e. If 4% is supposed, the real data do not must be a 24%).
- Speed does not differ more than 40 km/h with the real. (i.e. if a road is assigned to 50km/h, the vehicles do not pass at 90 km/h).

Only in those cases where it would be necessary to prepare a detailed study for the definition of particular urban development actions, more variables should be considered in the characterization of noise and also more accurate baseline data should be used.

The following chapters illustrate the methodology applied in the characterization of all road traffic within the elaboration of Strategic Noise Maps for two urban agglomerations in the Spanish context: Zaragoza and Gijón.

In the development of this task, available data from the city council and the best practice guide for the development of noise maps (WG-AEN 00 2006) have been used as key references.

References and baseline information:

Due to the effort and resources that are necessary to develop a traffic modelling for all the roads in an agglomeration, this task is not justified solely for the elaboration of the Noise Map. It is necessary to combine this aim with getting information regarding several aspects of city management.

In the particular case studies analysed in this paper, traffic models are not available. Thus it is important to elaborate a proposal for traffic data within the municipality, taking into account the point of view of the department responsible for urban traffic or/and mobility within the local administration. This is a crucial aspect since this department should facilitate data and also verify that the proposal is developed as close to reality as possible.

For the study cases, the proposal has been developed bearing in mind that the acoustic analysis requires a relatively low precision due to the logarithmic scale of noise.

The baseline information that is available in the two urban agglomerations is as follows:

	Zaragoza	Gijon
AVT*	Main roads with traffic light control	Main roads with traffic light control
Traffic flow distribution	Main Roads	No data available
Percentage of heavy vehicles	Main Roads	No data available
Speed	Main Roads	No data available

*: the city councils usually collect traffic data from the main roads in order to manage the traffic light control, but it is not common to have data for the whole traffic network.



The attached image shows those roads, in Zaragoza, that have official traffic information.

It is generally accepted that there is an important lack of data for the characterization of the traffic movements for the whole agglomeration. Because of this fact, it is necessary to make a number of assumptions in order to have appropriated information for noise mapping, optimizing resources available and taking into account the Good Practices Guide recommendations

The recommendations of the guide WG-AEN-002.2006 that have been considered are as follows:

- Tool 2.2.: Traffic flow for two periods, day and night, or a full 24- hour day.
- Tool 2.5.: No traffic flow available.
- Tool 4.5.: No heavy vehicles data available

Assumptions and method proposal

Considering the available data in the case studies as well as the guide tools, the criteria used to elaborate the traffic data proposal for the whole agglomeration is as follows:

- Categorise the roads of the city in the Good Guide Practice types.
- Use up-to-date and official data when available.
- Finally, extrapolate the information for each kind of road using real data on top of the Guide's criteria.

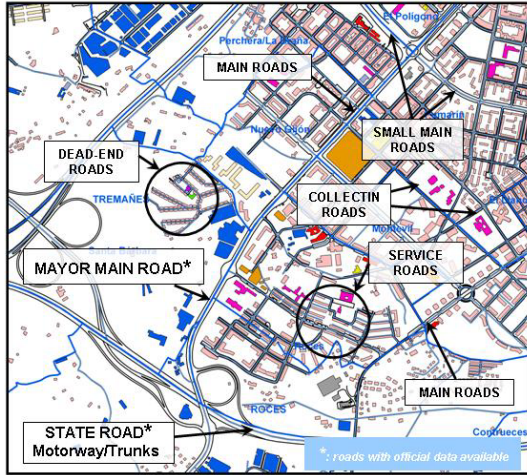
So that, the method proposed is as follows:

- 1- Firstly, to implement the official data from the traffic department (local, regional and state government roads) in G.I.S. It would be necessary to make additional counting for the main roads and extending data for those roads that are a continuation of other roads with assigned data.
- 2- Secondly, to categorise the roads according to the Good Guide Practice types. In order to undertake this task, road function and AVT up-to-date data is considered as a reference. The function of the guide road type is as follows:

- Main roads: roads which connect the primary traffic network with the accesses and exits of the agglomeration.
- Small main Roads: roads which connect the districts with the major main roads and different districts each other.
- Collecting roads: roads inside the districts that collect traffic from the service roads and take it to the main roads and the primary network. They are also roads that connect different parts of the same district or neighbourhoods.
- Service roads: They are used by the residents in the area to move inside the district.
- Dead-end roads: Roads without exit or with a low flow used to park.

In order to develop this task, field work would be necessary to get a better knowledge of the agglomeration and to review the proposal made by the responsible departments in the local administration.

- 3- Finally, to assign traffic data to all the roads, as detailed in the following paragraph.



Categorization of road types based in the Guide criteria in Gijon.

Assignment of the AVT data for roads lacking up-to-date data

When official information is not available or available data are not enough, the AVT data is obtained by considering data from traffic surveys and the Guide road type assignation. To develop these task the tool 2.5. criteria is followed. The proposal is as follows:

Road type	AVT data
Death-end roads.	Data from the tool 2.5.
Service roads	It is assumed the half of the AVT data of the colleting roads.
Collecting roads	The AVT data corresponds to the average of the roads of this type with actual data. If there is not roads of this type with data available, the AVT is the half of the data of small main roads.
Small main roads	The AVT data corresponds to the average of the roads of this type with actual data. If there is not roads of this type with data available, the AVT is the half of the data of main roads.
Main Roads	The AVT data corresponds to official capacity data or based on counts made during field work.

Allocation of heavy vehicles percentage in roads

As it has been showed for the AVT data, the percentage of heavy vehicles is obtained considering traffic official data (that used to be less than the AVT information) and the type of road definition. To develop these task the tool 4.5. criteria is followed. The proposal is as follows:

Road type	Percentage of vehicles data
Death-end roads.	It is assumed the half of the % data of the service roads.
Service roads	The % data corresponds to the half of the data allocated for collecting roads
Collecting roads	It is assumed the half of the % data of the small main roads.
Small main roads	The % data corresponds to the half of the data allocated for main roads
Main Roads	The % data corresponds to official capacity data or a assumption based in this official data for similar roads..

It is considered that theses data refers to the day period.

In relation to the industrial areas special analysis is required in order to obtain the percentage of heavy vehicles, discriminating between roads within the agglomeration and the accesses.

So, if we have some real or counting data for percentage of heavy vehicles for some roads classified by the Guide typology, estimation for the total roads of the agglomeration could be carried out.

Assignment of the traffic time distribution in roads without real data

Distinction between light and heavy vehicles is critical to develop this task:

For Light vehicles tool 2.2. has been used.

Traffic data (Percentage of light vehicles for each period)			
Road Type	Day	Evening	Night
All	70%	20%	10%

Tool 4.5. has been used for heavy vehicles:

Traffic data (Percentage of heavy vehicles for each period)			
Road Type	Day	Evening	Night
Death-end roads.	It is assumed the half of the % data of the service roads.	It is assumed the half of the % data of the service roads.	0%

Traffic data (Percentage of heavy vehicles for each period)			
Road Type	Day	Evening	Night
Service roads	This data refers to the information showed in the "percentage of vehicles data" table	It is assumed that the data for the evening corresponds with half of the day	The night data is the half of the evening data.
Collecting roads	This data refers to the information showed in the "percentage of vehicles data" table	It is assumed that the data for the evening corresponds with half of the day	The night data is the half of the evening data.
Small main roads	This data refers to the information showed in the "percentage of vehicles data" table	Reduction of 35% on the day data.	Reduction of 50% on the day data.
Main Roads	This data refers to the information showed in the "percentage of vehicles data" table	Reduction of 35% on the day data.	Reduction of 35% on the day data.

In the particular case of industrial areas, distribution of collecting roads is used to obtain distribution of heavy vehicles circulation in each period.

Allocation of the speed data in roads without real data.

Regarding speed data in urban areas, it is important to take into account some aspects related with the calculation method which must be applied in this case:

The French national computation method 'NMPB-Routes-96 (SETRA-CERTU-LCPCSTB)', referred to in 'Arrêté du 5 mai 1995 relatif au bruit des infrastructures routières, Journal Officiel du 10 mai 1995, Article 6' and in the French standard 'XPS 31-133'. For input data concerning emission, these documents refer to the 'Guide du bruit des transports terrestres, fascicule prévision des niveaux sonores, CETUR 1980'.

Implementing this method represents a major problem when low traffic speed (below 50 km/h, usually in urban areas) is considered, because the calculation shows a tendency to increase the noise levels as the speed goes down, especially when heavy vehicles pass-by.

In order to follow the Directive 2002/49/EC the interim method is going to be applied. This means that, to avoid no representatives results in this first strategic noise map, it is assumed that there will be no roads with less speed than 50 km/h.

However, because of the fact that it is interesting to analyze the acoustic benefit of some actions derived from speed reductions, a first estimation of the noise reduction with the speed has been done.

This proposal is made considering three methods whose traffic noise emission database is more recent than the interim method.

- Provisional review of the national French method.
- Nord 2000 method.
- HARMONOISE-IMAGINE.

In these three cases, the trend of the noise levels decreases with the traffic speed. After an analysis of the three methods the estimation is shown below:

Correction (dBA) over the value calculated for a speed of 50km/h.

Speed	30 km/h	40km/h
Light vehicles	-4,5	-2
Heavy vehicles	-3	-1,5

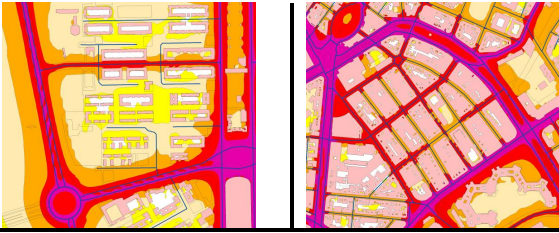
Conclusions

The method applied to obtain the traffic data that is going to be use in the development of a Strategic Noise Map for the whole agglomeration is based on the following criteria:

- 1- To dispose of official data or accuracy counts for, at least, main roads.
- 2- To categorize the roads in the Good Practise Guide (WG-AEN-002.2006) types.
- 3- To apply the Guide criteria for those roads without data considering the up-to-date and official data that are available for roads of each Guide type. This paper proposes the use of data corresponding to official traffic information or based on counts, when possible. If this kind of data is not available it is recommended to follow the Good Practise Guide. But instead of taking into account the absolute default values, the relationship between the different roads types should be used, in order to characterize the traffic distribution in the city for noise mapping.

This method allows getting traffic information related to the acoustic reality of the urban area and it could give general view of its traffic soundscape.

So, the Noise Map that has been obtained, shows, not only the most affected places (which are recognized as priority areas in the actions plans) but also the quiet areas and the benefits of having roads with less traffic flow or speed:



Differences in the generated noise between a less traffic central area (left picture) and a general high traffic configuration (right picture)

On the other hand, this task provides a first traffic database that can be improved and adapted to other city council necessities and studies in order to make decisions linked to the city design and with its sustainable management.

However, because of the fact that traffic is usually the main noise source in the agglomerations, it is necessary to make an important effort in order to improve this data and reduce its uncertainty to be able to develop the action plan for traffic management.

The data that should be improved is shown below:

- Baseline information: This is crucial when mitigations actions are necessary, making permanent counting on more roads and having data of percentage of heavy vehicles and speed.
- Methods: the interin method does not reflect noise emission reality of the vehicles at low speed. This is a inconvenience when trying to analyze the acoustic benefit related to the traffic calming.
- The Guide WG-AEN-002.2006 tools constitute a first approximation but, as it is stated in the guide document, can not substitute the official or counting data.

Thanks to:

Zaragoza Council, Agenda 21 department.
Gijón Council, Department of Environmental Management.