# "THE PROCESS OF STRATEGIC NOISE MAPPING OF SPANISH MAJOR ROADS (EGRA): FIRST RESULTS ALREADY AVAILABLE"

**Itziar Aspuru; Fernando Segués,**

**Jesús Rubio y Manuel Vázquez**

**Fecha: 30 Mayo- 1 Junio 2006**

# THE PROCESS OF STRATEGIC NOISE MAPPING OF SPANISH MAJOR ROADS (EGRA): FIRST RESULTS ALREADY AVAILABLE

**Itziar Aspuru[1], Fernando Segues[2], Jesus Rubio[3] and Manuel Vazquez[1]**

[1]Labein-Tecnalia
Parque Tecnologico de Bizkaia, 48160, Derio, Spain
iaspuru@labein.es

[2]Centro de Estudios y Experimentación de Obras Públicas (CEDEX)
[3]Dirección General de Carreteras, Ministerio de Fomento

## ABSTRACT

The Direccion General de Carreteras of the Spanish Ministry of Transport is clearly driving the process of Strategic Noise Mapping of Major Roads by the EGRA project. The key issues to be considered during the process are: The quality of the results, taking into account that there is not so much experience in Spain in the methodology proposed by the European Noise Directive; The need of getting harmonized results among the whole network; The intention of doing a transparent approach and setting a collaborative framework with the Environment Ministry, the Direccion General de Ferrocarriles (Railways), and Regional Governments; and finally The interest on getting useful results of the process.

The process is already on and on that sense all the network where a Noise Map should be done for 2007 is identified, it is divided into sectors to be contracted and by 2007 all the Noise Maps (around 6.400 km) will be done.

The whole process considers the following issues: The capability of the sector; The methodology for Noise Mapping; The input data; A quality control for the Noise Mapping process; A set of publications for capability building.

## 1 INTRODUCTION

The whole network will be noise mapped under 20 different contracts and the key issue is to guarantee that the final result is a coherent Strategic Noise Map of the Spanish Major Roads.

The Directive requirements should be fulfilled, solving the compromise between precision and practicability.

## 2   METHODOLOGY FOR NOISE MAPPING

### 2.1   General concepts

In general, Strategic Noise Maps should be a tool to assess the exposure to noise and they should content at least two differentiated elements:
- Noise Level Maps: Isoline noise level maps created from the noise levels obtained over the whole studied area.
- Exposure to Noise Maps: Surface and population exposure to noise estimated from the analysis of land uses and type of buildings in the area.

The strategic noise maps of the major roads in Spain are being done in two phases: Phase A, Basic Strategic Noise Maps; and Phase B, Detailed Strategic Noise Maps.

*Table 1. General structure of the concepts and phases of Strategic Noise Mapping.*

| Strategic Noise Maps | Phase A<br>Basic Strategic Noise Maps<br>1/25.000 | Phase B<br>Detailed Strategic Noise Maps<br>1/5.000 |
|---|---|---|
| Noise Level Maps<br>Isolines and Exposed Area | 1. $L_{den}$<br>2. $L_{night}$<br>3. Exposed Area | 4. $L_{den}$<br>5. $L_{night}$ |
| Exposure to noise maps<br>Noise levels at building facade and exposed population | Most of the results of exposed population will be created from the Detailed Strategic Noise Maps | 6. $L_{den}$<br>7. $L_{night}$ |

First of all the Basic Strategic Noise Map is done using the cartography 1/25.000. Analyzing the results of these maps some affected areas could be identified for a Detailed Strategic Noise Map to be done with a 1/5.000 cartography and a more precise methodology. The criteria to select the areas where a Detailed Map is required are related to the expected exposed population, so it is decided after studying the land and building uses; for example, dense urban areas with residential, hospitals or educational uses would be studied in Phase B.

In order to organize the Strategic Noise Mapping of the whole Spanish network the Unit of Strategic Noise Map was defined as the Noise Map which contents each Road as a whole, without taking into account any other parallel or crossing road. Each of the Units of Strategic Noise Maps has been split in maps for its publication and printing, according to the general criteria for public maps established by the Spanish National Cartography Service (CNIG).

## 2.2   Calculation methodology

To establish the harmonised calculation methodology for all the Major Road Strategic Noise Maps, CEDEX did a previous pilot study [1]. As a result of this study the following decisions were made:

- The calculation method is the interim method, defined by the END: NMPB-Routes-96 the XPS 31-133 and the "Guide du bruit des transports terrestres, fascicule prévision des niveaux sonores, CETUR 1980".
- It is recommended that the area of study would be 1,5 times the maximum distance where $L_{den}$ is 55 dB or $L_{night}$ is 50 dB. The distance could be less and the area irregular, but it should contain at least the isoline $L_{den}$ 55 and $L_{night}$ 50.
- Population and land uses: The residential, sanitary and educational land and building uses should be identified and the population in the buildings should be estimated.
- Assessment parameters are $L_{den}$ and $L_{night}$ at 4 m. over the ground. Besides, $L_{day}$ and $L_{evening}$ are also calculated.
- Calculation parameters: a) two degree of reflections, b) ground absorption coefficients should be estimated, and c) the meteorological conditions will be the ones established by the Good Practice Guide of WG-AEN [2].

Noise Level Maps:
- Reception points will be defined according to a regular or variable grid with a medium distance of 30 m. in the Basic Noise Maps and 10 m in the Detailed Noise Maps.

Exposure to Noise Maps

Most of the results about exposed population will be created from the Detailed Strategic Noise Maps (Phase B). On this phase the analysis should be done based on each façade element, assigning noise level and population to reception points related to each of them.

The Exposure to Noise Maps in the areas which were not selected to be studied on Phase B will be done in a more simplified way. The base of the analysis of exposed population is the building and, in general, the whole building could be assessed by the closest noise level range looking into the Basic Strategic Map of the area.

## 2.3   Input data

The data referred to the road infrastructure (traffic and road surface) were estimated by the Competent Authority and this information will be published in each call for contract. The type of circulation is set as fluid by default.

Consequently, the Ministry establishes traffic characteristics for each road sector: Intensity per hour, medium speed and percentage of heavy vehicle during the day (7-19h), evening (19-23h) and night (23-7h) periods. The contractor should check this information and advise for changes in case relevant deviations are found (25% of deviation on traffic intensities and 5 km/h deviations on speed estimations).

Each contractor should look for the input data referred to the environment of the road: cartography, related position between road platform and ground, land uses and population.

## 3   QUALITY CONTROL

The goal of the quality control procedure is to check the acoustic quality of each Strategic Noise Map and to assure the coherence of the whole process of Strategic Noise Mapping the Spanish Major Roads in 2007.

On that sense, the procedure goes further than controlling the reception of the reports and maps and giving acceptance to the final Strategic Noise Map. It is a process that follows each of the 20 contracts by means of established check points which avoids having to go backwards in the project. These check points are related to critical points in the Noise Mapping process: a) Input data acquisition and processing; b) Model building and calculation parameters;        c) Calculation results; and especially, d) Decision about where a Detailed Noise Map is not needed.

The quality control procedure is already public [3] and it is being applied by the quality control team, composed by CEDEX and LABEIN. The contractor receives standard formats for maps and final report.

The control process is focused on three key check points which are analysed in both Phases, Basic and Detailed Strategic Noise Maps:

a) Input data: The quality of available input data is analysed and the methodology to improve it and to introduce it in the model is discussed. The main issues to consider are the cartography (ground and road elevation, buildings, etc); and the methodology to get the population related to each building. At this moment the contractor and the quality control team make a visit to the studied area to establish the precise definition of the starting and finishing points of each Unit of Strategic Road Map and to discuss where Detailed Noise Maps are not needed.

b) Model building and calculation parameters: Calculation parameters are already fixed by the Competent Authority. However some simplifications could be proposed, although all of them should be justified and discussed, before being accepted. Previous to calculate Noise Maps the contractor should send the project (an acoustic software file) and the shape files of the built model. On that way, calculation parameters and the model could be checked (road description and obstacles) and a copy of the project is saved.

c) Calculation results: The resulting Noise Level Maps (Isolines and Exposed Areas) are sent in pdf and shape formats and they are analysed in a simplified way looking their coherence.

## 4   FIRST RESULTS

The first Strategic Noise Maps have been produced and Figures 1 and 2 show examples of the Strategic Noise Maps of Spanish Major Roads. All the maps are done according to the same format, where all the project references are reported. The Unit of Map is referred with the number of road and to the starting and finishing point. The legend of the cartographical information is similar to the standard road maps (topography, building, roads, etc). The buildings are shadowed to

differentiate three categories: residential use, commercial or industrial use, and hospital and educational use.
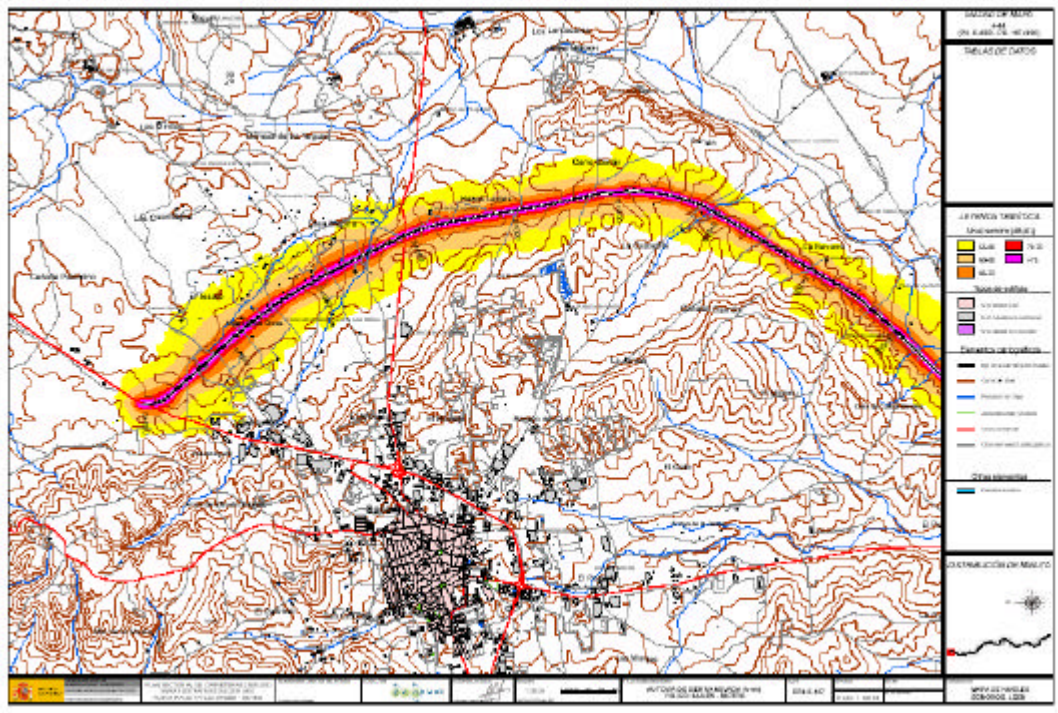


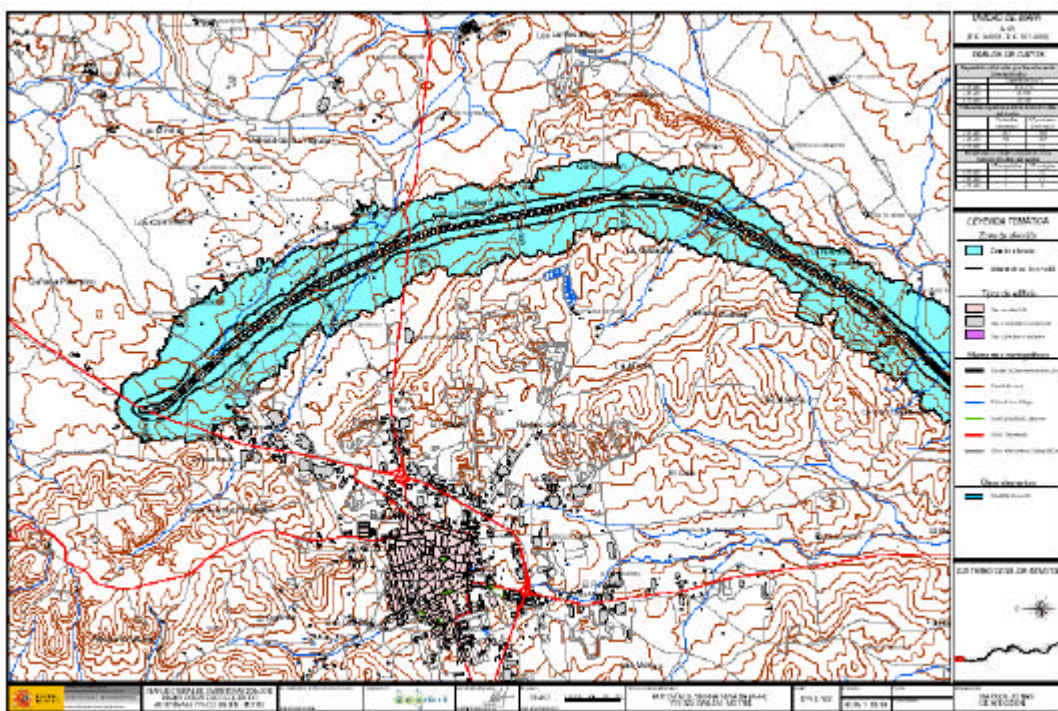*Fig. 1.Example of a L_{den} Strategic Noise Level Map of a Major Road .*



*Fig. 2. Example of a Exposure to Noise Map of a Major Road.*

Figure 1 shows the $L_{den}$ Strategic Noise Level Map done by a Basic Map and Figure 2 shows an Exposure to Noise Map where the exposed area is described by the 55, 65 and 65 dB isolines. This map also contents three tables with exposed area (number of square kilometres in each $L_{den}$ noise level range, >55dB, >65dB and >75dB); exposed population (number of inhabitants in each $L_{den}$ noise level range) and exposed dwellings (number of dwelling in each $L_{den}$ noise level range); and number of educational buildings and hospital in each $L_{den}$ noise level range.

## 5   CONCLUSIONS

The assessment of the Spanish Major Roads will be done by 2007 thanks to the exposed process. The consequence of this effort is not only a complete assessment of the exposure to noise due to Major Roads.

The process also includes a compilation of information about acoustic obstacles close to the road already thinking on the Action Planning.

It is expected a clear improvement on the capability of the Spanish consultants on environmental acoustical assessment. The quality control process is a balanced compromise of identifying bad practices or weakness of the acoustic software, and showing how to solve the most common problems.

On the other hand the process will be a methodological reference for the Strategic Noise Map of Spanish Major Railways or other Competent Authorities which are involved on the answer to the European Noise Directive.

## REFERENCES

[1]   F. Segues and Maria Dolores Jiménez, "Estudio para la determinación de las especificaciones técnicas en la elaboración de Mapas de Ruido de carreteras", Dirección General de Carreteras, Ministerio de Fomento y CEDEX.

[2]   European Commission Working Group Assessment of Exposure to Noise (WG-AEN), Position Paper: Good Practice Guide for Strategic Noise Mapping and the Production of Associated Data on Noise Exposure Version 1, December 2003.

[3]   F. Segues and M. Vazquez, "Control de calidad de los mapas estratégicos de ruido de carreteras", Tecniacustica 2005.