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Experiences in introducing Noise Management Processes: Particular Needs require Particular Solutions

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Different Authorities are introducing the Noise Management concept as an integrated process that helps to develop activities on assessment, prevention, correction, public information and participation. On that sense they try to involve on this process to spatial and noise source managers. This paper refers to experiences leaded by different authorities, and analyses three subjects. Firstly, it shows problems and practices when different departments and authorities are required to take part in the process. Secondly, it exposes the aspects to be taken into account in each case to adapt the process and the system that supports it. Surely, there will be some particularities on the approach done by authorities according to their needs and priorities, to the situation to be managed, to the administrative structure, or to the availability and quality of input data. The noise management process should adapt to each situation. This will lead into particularities on the scope of the process, on the actors involved, on the system that could support it, and on the technical methodology applied. Finally, the paper analyses two specific Noise Mapping implementations, applying the Good Practice Guide published by WG-AEN. It assesses and compares the input data used in each case and the methodologies applied to answer to the END. The paper is based on the experience of Labein introducing Noise Management System in different Spanish authorities and, in particular, on two projects done for the Environment Departments of Diputación Foral de Bizkaia Provincial Authority) and Gobierno Vasco (Regional Authority).

1 Introduction

This paper refers to the experience of Labein designing and implementing noise management processes. It describes two specific projects. It describes the needs and priorities, analyzes the problems found, and it also shows the quality analysis of the Noise Mapping.

1.1 CIFRA

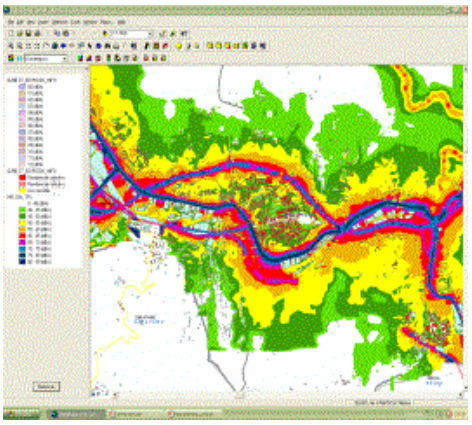

Figure 1: Result of CIFRA project.

CIFRA project answers to the need of the Environmental Competent Authority of the Basque Government (Gobierno Vasco) for managing environmental noise.

The general objectives of the project are:

To *comply with* European Noise Directive [1] and Noise Spanish Law [2] *requirements*, regarding environmental noise in the Basque region. On that sense the project should help to do strategic noise maps of transport infrastructures.

It also *provides tools* for general environmental noise management.

And other objective is to help Authorities in their general aim of *serving to citizen* in terms of environmental noise information, participation and awareness.

1.2 SIGRU

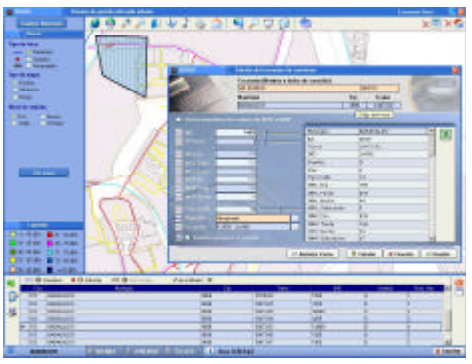

Figure 2: Scenarios Manger of *SIGRU* System.

SIGRU project intends to manage urban environmental noise. It has been supported by the Environmental Authority of Bizkaia, one of the Provinces of the Basque Country [3, 4].

The Province Authority has no real competencies on urban noise, but it decided to help municipalities on their answer to the growing social annoyance caused by noise. *SIGRU* is going to harmonise the methodology of assessing environmental noise, it will help on using some needed data that is managed at the province administration and it will offer a dynamic tool to manage noise sources and to optimise the efforts on updating the diagnosis.

Most of the municipalities are not agglomerations according to the END definition, so there is no official obligation to do acoustical management.

In the following figure the relationship between both projects and with the Authorities is presented.

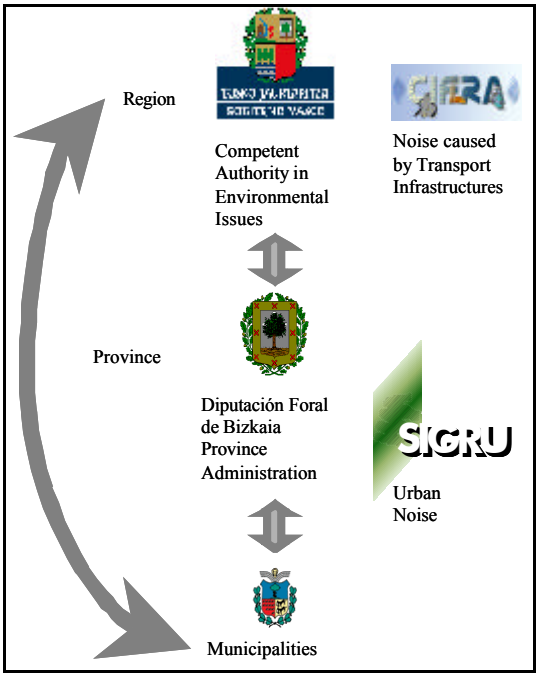

Figure 3: Relationship between both projects.

1.3 Needs and Priorities

The description of the needs for the authorities in each project is done according to six different issues:

Recompilation of environmental noise studies:

The main objective of *CIFRA* is to support the management, according to END, of noise caused by transport infrastructures (roads and railways). As the Environmental Department is responsible for assessing the impact of economic activities, *CIFRA* also supports the management of industrial noise.

It contains and shows the previous noise map of the Basque Country, done during the past years applying assessment methodology and parameters which are different than the ones proposed by END.

It also offers the possibility to show and overlap contour lines of any kind of acoustical assessment in the area (Environmental Impact Assessment studies, agglomeration or airport Noise Maps or others).

SIGRU supports the management of urban environmental noise in the province of Bizkaia. It should recompile noise maps done by different municipalities with an harmonized methodology.

Data Analysis

Both projects have to analyze the results obtained in order to help in the sound quality assessment of the situation under study. The diagnosis should be done combining sound level and sensitive uses of land and buildings. Results should be easily understandable for people without acoustical background.

Updating, Tendencies analysis

END requires to update noise mapping each five years. Therefore, it is important to optimize efforts when updating the assessment. Tendencies analysis helps in the diagnosis of the global situation and of the effect of strategic policies.

Scenarios simulation

Management processes requires capability to answer to "what if" questions. Therefore, there is a clear need for simulating tools to predict and assess non existing situation. Action Plans should be defined analysing the expected benefits of proposed abatement measures. On the other hand, there could be other changes due to noise sources management (traffic or industries) or land use plans that could affect the noise impact.

There are some differences in the need of simulating capabilities on both projects. *SIGRU* manages urban noise and the abatement measures to be checked are mostly focused on the source conditions or on prevention. *CIFRA* has a broader scope, so it should simulate the effect of any type of measures, including those that change the sound propagation.

Agents implied in the process

Both Environmental Authorities want to involve other Departments which deal with noise source management (transport or industry) and with spatial planing which affects acoustical zoning. There is a need for setting collaboration practices and therefore tools to share information and decision making will be welcomed.

Public Information

The management process should include public information and participation. It is mainly a political decision to establish the content and ways to do it, but

some technical tools and specialist opinion should help on this task. *CIFRA* project includes a tool to give information to the public, meanwhile *SIGRU* project leaves this functionality to further developments.

Priorities

To summarize we will stress some differences in the purposes of both projects: *CIFRA* should be very powerful to simulate all kind of modifications and should manage assessments done applying different methodologies. *SIGRU* manages harmonised information, and it would be used by, not only different Departments, but also different authorities.

2 Process proposed

The aim of both projects is to create the base for a noise management process which is described by:

A *way of working*, based on involving departments that should take part on assuring the quality of the data needed to manage the acoustical situation and on updating them. Departments that should also be involved on the strategic measures to reduce noise annoyance and to protect quiet areas.

This way of working has implied that each project has been adapted to the specific administrative structure and to specific policies for data and tools management.

An *acoustical methodology* that defines how the END requirements could be achieved, taking into account the quality of the available data. We understand that the implementation of END is not finished and that some changes on methodology are expected in the near future. Therefore we have stressed the importance on creating a good basis for the process and on assuring an easy reaction to changes on methodology.

A *software tool* that combines innovative technologies on acoustics, data management and spatial analysis.

The idea of both projects is to design, develop and implement a software tool that could help in the settlement of the process for noise management and that could help to involve on it to different departments and authorities. Therefore, the developed systems are not the main goal of the projects; they are intended to facilitate the starting of a good noise management process.

3 Designed Systems

3.1 CIFRA

The software application developed in *CIFRA* is designed to be used in combination with an acoustical software which will simulate the effect of changes.

The information needed to do the noise maps of the transport infrastructures of the Basque Country is spread in six different departments or services.

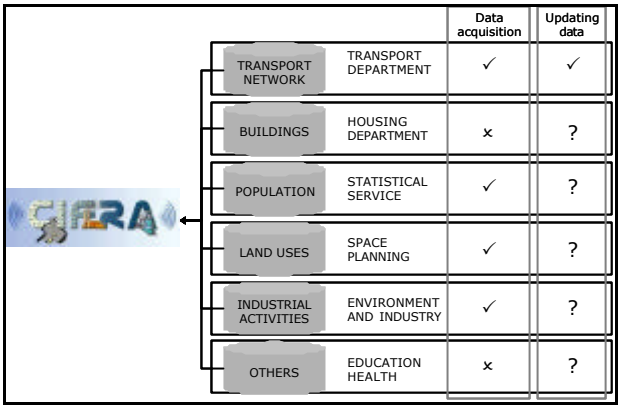

Figure 4: Data managers and their involvement in the project.

The Basque Government is involved on a global initiative (GEOEuskadi) related to data management. The development of *CIFRA* was influenced by it, positively in terms of sharing the concept of communication between departments, and negatively in terms of the timing of the project. The decision about formats and GIS platform for the application was done by the Basque Government.

As it is said above, one of the objectives of the project was to facilitate the public information. It was decided to develop two different applications.

An *Intranet application* to do noise management and to communicate the involved departments in the Basque Government. It was developed in ARCGIS technology and it supports heavy information and management tools. The volume of data that *CIFRA* manages is great, there are around 7.000.000 receiver points with acoustical information associated. It shows information about characteristics of noise sources and about noise contribution at receiver. Ant it allows doing changes in the described situation.

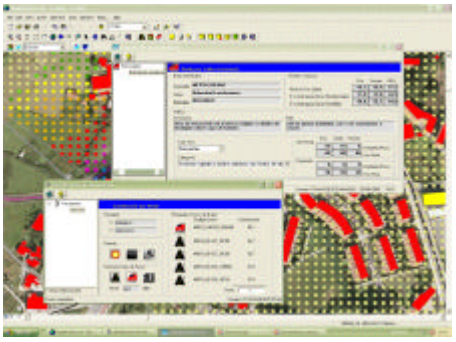

Figure 5: Intranet application, showing information about sources and about contribution at receivers.

An *internet application* which will be used for public information with less amount of data to allow rapid access. It is developed in Arc IMS Technology.

Figure 6: Internet application.

The project was leaded by Labein and the software development was done by SITESA, a company expertise in ArcGIS technologies and it has developed other applications for Basque Government.

The system creates automatically reports about the sound situation of selected areas. It applies some clear indicators to evaluate noise situation, developed in the project.

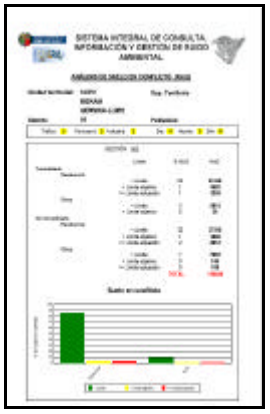

Figure 7: Report created by *CIFRA* about the exposure of land to noise.

3.2 SIGRU

The system was designed by Labein and it was developed in collaboration with Lantik, the company which works for Province Administrations creating software applications, compiling data from municipalities and managing them.

The whole process is the following: municipalities do their Noise Maps, they send the results to the Province Administration, it loads the data on the application and each municipality can access to the application in order to mange their urban noise. One of the key points on this project is the accessibility to the system from municipalities. On that sense, the system should be friendly and easy to manage, it should control access into the database, communication should be fast enough to be useful, and it should not need great investment for the municipalities in communication network or in hardware system.

On the other hand, the system should grow by incorporating more Noise Maps, done by different authorities and in different time. In any case the diagnosis of the situations should be comparable.

The collaboration with Lantik imposed the use of MAP Objects Technology and this decision implied some consequences in the development.

In order to simplify the needed investment of municipalities, *SIGRU* was designed to create and analyze scenarios independently of any acoustic software. This decision limits the type of changes that the system can simulate. Therefore, the simulation is achieved by different processes depending on the type of changes to study, as it is shown in Figure 8.

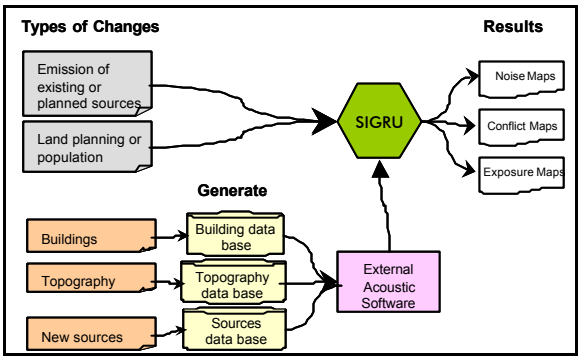

Figure 8: Change management to simulate scenarios.

Abatement measures in urban noise are usually related to changes on noise sources or to preventive actions to avoid future conflicts by conditioning urban planning. *SIGRU* can estimate the benefit of such measures, so it is a real help to define action plans. However, to update data or to study measures that affect propagation an external evaluation is needed and obtained results are loaded into the system.

4 Problems and practices to involve authorities in the process

The main problem for *Environmental Authorities* is the few human resources and time they have to manage noise problems, as they have to deal with all environmental issues. This implies that they would need external help to manage and maintain the system. On the other hand, they understand the developed system as an integral tool which could incorporate the assessment of, not only the acoustical situation, but

other environmental factors, and it could analyse them from a strategic spatial planning point of view.

They value the system as a help on having a dynamic diagnosis of the acoustic situation, analysing tendencies and historical data and predicting non-existing situations.

As it is an innovative system, they want to be sure about its utility. Therefore, the planning of the project had intermediate "checking points" to demonstrate the results achieved and to receive their suggestions. As it was said above, the main goal of the projects was to facilitate the starting of a good noise management process. On that sense, the real use of the system is a top priority and some proposals that were planned have been left for future developments.

In general, the Environmental Authorities do not have too much influence and they have difficulties to involve other departments on the noise management.

Regarding *other Departments* involved on the process, there are several problems, but we have also found some good practices.

There are problems to get the needed information for Noise Mapping and most of the times the reason is that they do not have the data, they could not share the need, and do not put the resources to get them or to process them or to give them the required format.

There use to be also problems of scale, precision and language. They do not understand the type of management needed.

We have found good reactions to the management system and confidence on the obtained results when they have been involved on the data acquisition or they can recognise that we have used their information.

The source and land mangers see as a strong point of the process that they can simulate on the application the effects of changes they are studying, and it helps them to make better decisions and to quantify the achieved benefits related to environmental noise. On that sense they can use the information as complementary arguments to support their proposals.

In general, problems are caused by the few existing communication between departments, which makes difficult to collaborate and to make shared decision.

5 Quality analysis

5.1 Input data

The quality analysis of input data is done for both projects, as there are no big difference on them. We have applied the Toolkits for Noise Mapping included on the Good Practice Guide published by Working Group of Assessment of Exposure to Noise [5].

Table 1: Input data quality analysis.

Road traffic volume	**complexity**	**accuracy**	**cost**
There is official information of traffic on **main roads**, for a full 24-hours day. In order to **distribute** it in day, evening, night data, Labein has **selected sample roads** and has **counted traffic** on each period. Results were **extrapolated to other roads** of same type.			
On other roads and **streets** there is not official information of traffic. Labein has selected **sample streets** and has **counted traffic**. Results were **extrapolated to other streets** of same type.			
Composition of Traffic	**complexity**	**accuracy**	**cost**
There is official information about the percentage of heavy vehicles on **main roads**, for a full 24-hours day. **Typology of roads** and **counting on sample roads** mentioned above were also applied to set composition of traffic in day, evening, night.			
On other roads and **streets** there is no percentage of heavy vehicles available. **Typology of streets** and **counting on sample streets** mentioned above were also applied to set composition of traffic and distribute it in day, evening, night.			
Average road traffic speed	**complexity**	**accuracy**	**cost**
There was no speed data available and the **speed limit** from traffic signs were taken.			
Train speed	**complexity**	**accuracy**	**cost**
Train speeds are **delivered by the operators of the trains.**			
Sound power level of industrial sources	**complexity**	**accuracy**	**cost**
Measure noise level according to ISO standards, that were simplified to get the **sound** power of relevant sources for day, evening and night. The information about source operating time is given by **source operator**			
Building height	**complexity**	**accuracy**	**cost**
Building heights are (digitally) available			
Obstacles, cuttings and embankments in the site model	**complexity**	**accuracy**	**cost**
To check and improve the official cartography the embankments and cuttings were identified by **on-site visits.**			
Sound absorption values for ground cover, buildings and obstacles	**complexity**	**accuracy**	**cost**
Default values proposed on the toolkit (WG-AEN) were used.			
Long term meteorological conditions, humidity and Temperature	**complexity**	**accuracy**	**cost**
Default values proposed on the toolkit (WG-AEN) were used.			
Number of residents of the mapping area or sub-areas and assignation to buildings	**complexity**	**accuracy**	**cost**
There is official information available of the number of residents for each building.			

In general, the effort and the accuracy is *well balanced*. The effort was focused on the types of data that are more critical for the assessment and more interesting for the management process: traffic and industrial acoustical power. As a consequence of it, we get a

good accuracy. The only exception was the road traffic speed, but it was a political decision. As the interim method is not very accurate in the prediction of low speed traffic, data of street traffic speed was neither very accurate.

Data to create the propagation model was available and had a very good quality, and also information about population. On the other hand, the meteorological conditions were described by using default values. Sound propagation in urban areas usually implies short distances so the relevance of this data is low.

5.2 Methodology

The *interim computation methods* mentioned in the END were applied. In order to achieved a good compromise between data accuracy, precision of the methods, and effort or cost needed, it was decided to assume some *simplifications*, especially when describing urban traffic and when characterising train emission.

The analysis of the acoustical situation is based on the amount of land exposed to noise, the number of people exposed to noise in their dwellings, and the number of people exposed to noise as users of sensitivity buildings.

Each project applied different methodology to **assign a noise level to the façade** of a building. *CIFRA* used the contour lines and the buildings to get by spatial analysis the portion of façade exposed to each noise level range.

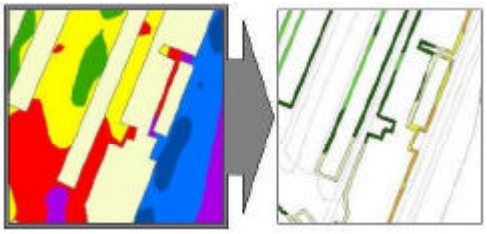

Figure 9: *CIFRA:* Assignment of levels to façades.

In spite of this, *SIGRU* system defined receiver points linked to each building and represented the façade by the noise levels predicted on those points.

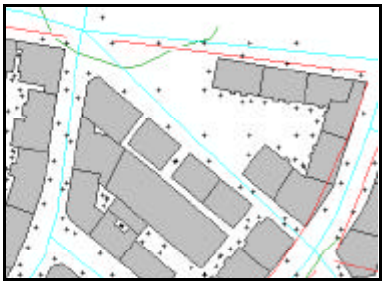

Figure 10: *SIGRU* Assignment of levels to façades.

These different approaches were caused by the particularities of each system and process. *CIFRA* has to manage a huge amount of information and the façade receivers would require a double calculation. And the GIS platform of SIGRU could not manage easily spatial analysis.

6 Summary

As a conclusion, the main points are to implement a good noise management process are to involve the authorities that can improve the noise situation, and to adapt the designed processes and systems to their particular needs and habits.

7 Acknowledgements

Labein would like to thank to the Environmental Departments of Gobierno Vasco and Diputacion Foral de Bizkaia because they have assumed the environmental noise as a key point among their projects, and they have also considered the new European Directive as an opportunity to establish an innovative concept of Noise Management.

The collaboration with SITESA and LANTIK has been essential because they have been the main creators of the software applications.

References

[1] Directive 2002/49/EC relating to the assessment and management of environmental noise, END.

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