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NOISE STUDY OF RAILROAD TRAFFIC IN THE CITY OF GIRONA

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ABSTRACT

During a six months period, readings of the noise produced by different types of trains were made (fast trains type "TALGO", conventional passenger trains and shipping trains) so were the speeds of all of them. This has been done on an elevated railway about 2 kms long, to check the distribution of "isophones" on the horizontal plan as on the vertical section. Different streets coming from the same railway were selected in order to realize these readings over different distances from the emission focus so this "isophones" could be appreciated and translated into graphs, and it's shape logically linked to the urban structure of the city. On the vertical section, noise controls were done over the same railway and in the adjacent buildings so the "isophones" could be obtained, and the incidence of noise in the different levels of the habitat be checked. Likewise surveys were done among the population straightly affected during the day and so at night, in order to check the degree of bothering caused by noise and related to the activity developed. At last the information has been utilized on the manufacture of noise maps from the city of Girona and currently the utilization of simulation models that allow including acoustic shields in order to minimize the noise inmissions in the surrounds.

The city of Girona is located in the northeast extreme of the Iberic Peninsula, about 60 kms. away from the french border, 100 kms from Barcelona and 40 kms from the Costa Brava.

There are two rivers going through Girona, the Onyar, and the Ter, and there are also three brooks. The former city of Girona was conformed only in the east of Onyar River, being separated from this by agricultural and forested lands.



Figure 1.

In the beginning of the century the city of Girona counted with one railroad in the far west part of the city, this was constructed over an embankment previously made for containing the river overflow, so the general location of the railroad was outside of the city.

With the development of the city, the tracks started to get surrounded with different kind of buildings, mainly habitation, which started to have the subsequent noise affections, after some years of studies and traffic problems, RENFE (The Spanish Train Company) decided to raise the railroad over the ground level. Key factors on this decision were the high sub terrain water level due to the proximity of the rivers to the tracks, and the high investment costs in solving the problem with tunnels, this made possible to build a raised track supported by concrete columns, which goes from about 500 mts south of the train station and ends two kilometers north of it.



(a)



(b)

Figure 2.

With this significant change in the context the tracks were located 7 meters above the ground level, this study was made around the noise caused by the traffic on this raised section of the track.

The city as it can be seen now has a major development in the neighborhood of the tracks, this along with the considerable increase of the traffic on this track over the last ten years, considering passenger and merchandise increase, as well as the frequency and trains with different characteristics as it can be seen in the table below, another point to consider is the fact, that all merchandise coming from the east part of France by train, runs through this tracks.

Train Classification	Day Frequency	Night Frequency	Estimated Speed	Longitude
Regional	175	75	60 km/h	78 mts
Long Distance	72	31	60 km/h	200 mts
Cargo Wagons + Locomotive	77	33	60 km/h	600 mts
Cargo Containers	49	21	60 km/h	600 mts
Varies	13	5	40 km/h	24 mts

Table 1: Monthly railroad traffic.

As it can be seen now the city has changed enormously in the west side of the track, now being surrounded by buildings and also being transformed from a barrier (the embankment) to a permeable railway, having parking lots below and streets communicating east and west.

At its time a thesis project, made on the Polytechnic Superior School, analyzed the noise distribution over the plan as well as in height, in several streets near the railroad. Readings were taken in function of the different kinds of trains, and speeds of them, this readings were made over different distances from

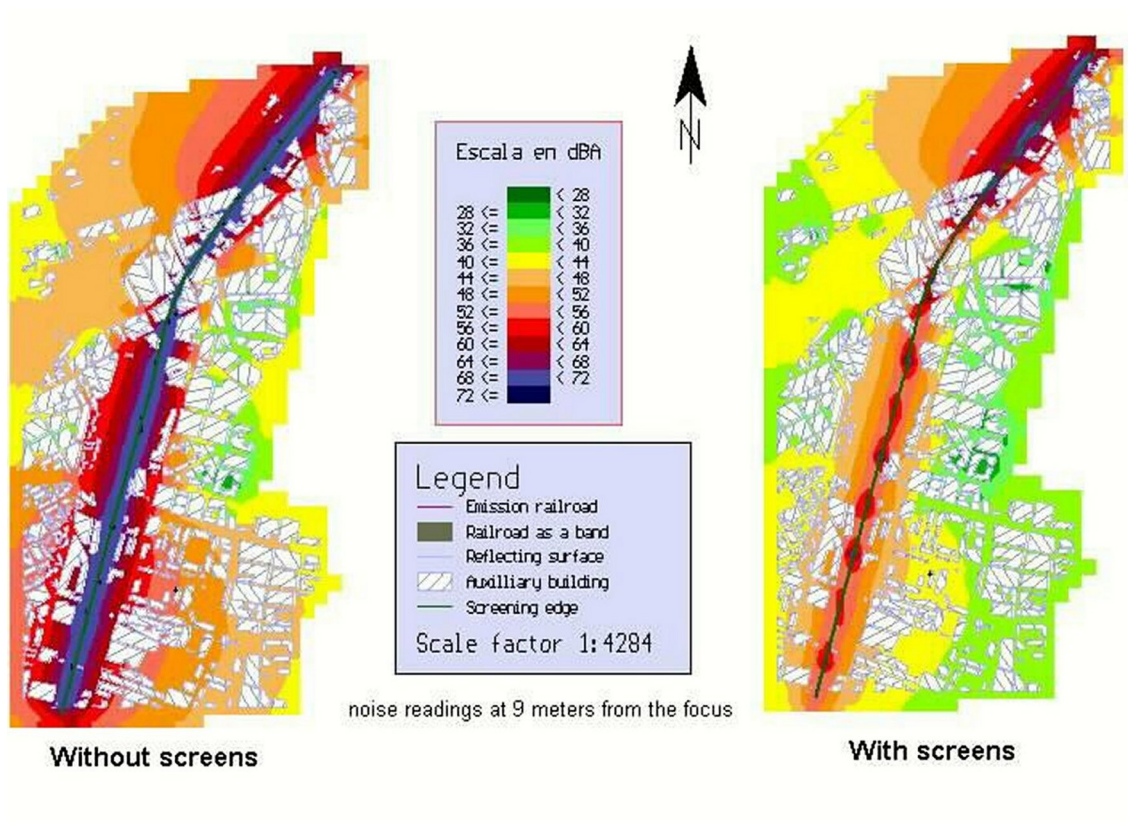


Figure 3.

the focus, over the sidewalk and in the middle of the street, all of this was normalized and re-adjusted by isophonic tables, along with the distance. In this study all other traffic noise other than the train was not considered, and in the height noise readings, constructions in the neighborhood were utilized, the study observed the relation between the speed of the trains and the noise produced by their circulation over the tracks, at the point of the readings, obtaining very acceptable correlation coefficients:

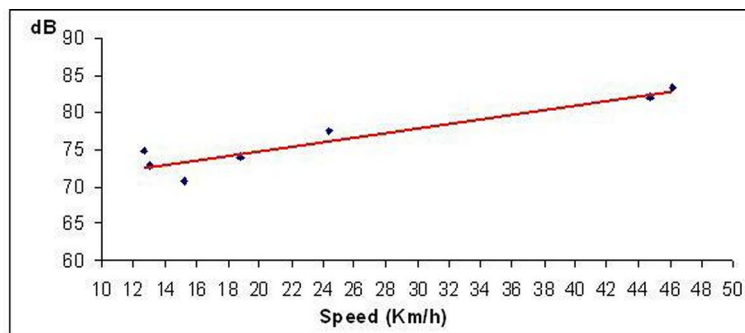


Figure 4.

this was done for each of the streets studied, and the most representative results were as follow:

As a complement of the study, a survey over the noise bothering between the neighbors was done, this showed the difference over the night/day perception also the results linked the noise bothering with the activities realized by the people.

Over the last decade a notable increase about acoustic contamination is taking place, therefore some city halls approved the first normative in this respect, as well as a study of noise level in the different parts of the city at this time the environmental department of Catalonia is developing the sound plan of Catalonia which will allow to urbanely classify the villages, in areas of small, medium and large sensibility, allowing in a near future to predict problems than in the past were found afterwards (Industrial perimeters, street

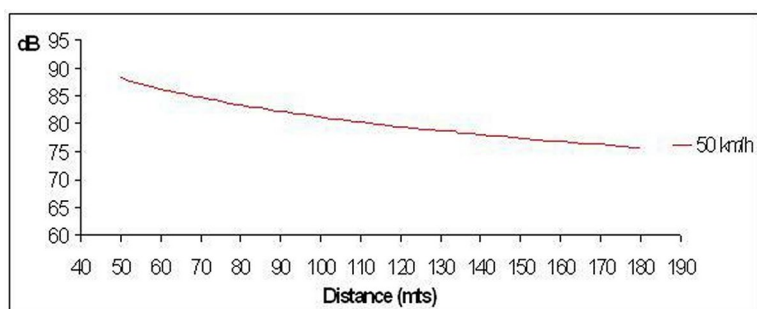


Figure 5.

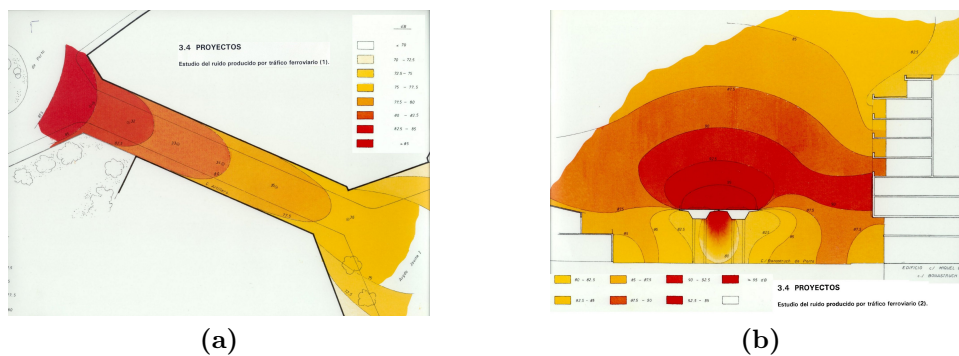


Figure 6.

extensions, old street's protection, etc.).

In the specific subject of this study, a project was asked to the LGAI (General laboratory for tests and research) in order to analyze the reduction over acoustic impact if shields were built in both sides of the track, using the same table presented (Table 1) When these figures are compared the results showed a dramatic reduction over the noise in the city. The high levels showed on the north part of the plan are due to the distance from the station, therefore the speed of the trains is considerable faster.

There are some points to arise:

1. Different institutions have done studies:
 - The University
 - The Generalitat (Catalonian government)
 - Local Institutions

This shows the complexity of the subject, including the public and the private transport by car (parking lots) therefore requiring deeper studies about them.

2. Social level of acoustic harassment is increasing, therefore social statistics will have to be taken in count and also link them with location and activity of the people consulted.
3. Implies the necessity of construction industry (design and build) to seriously face noise and vibrations problems in order to improve the habitat's comfort.

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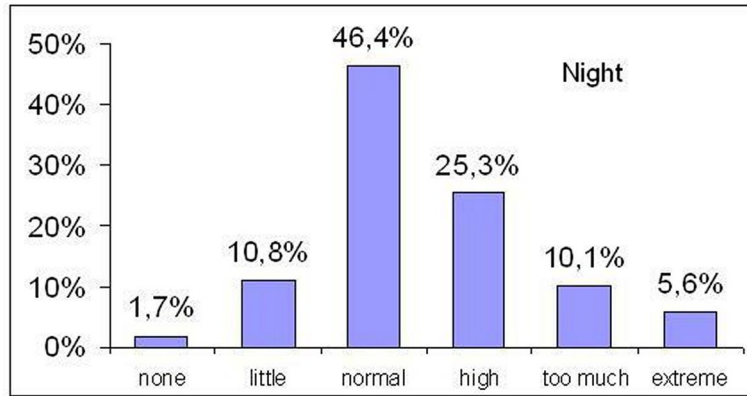


Figure 7.

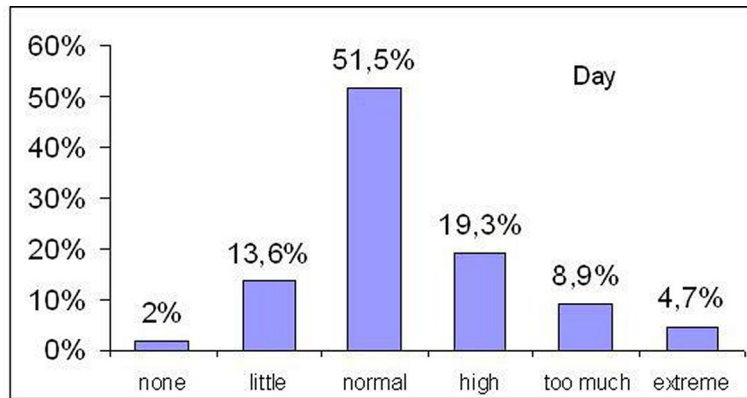


Figure 8.

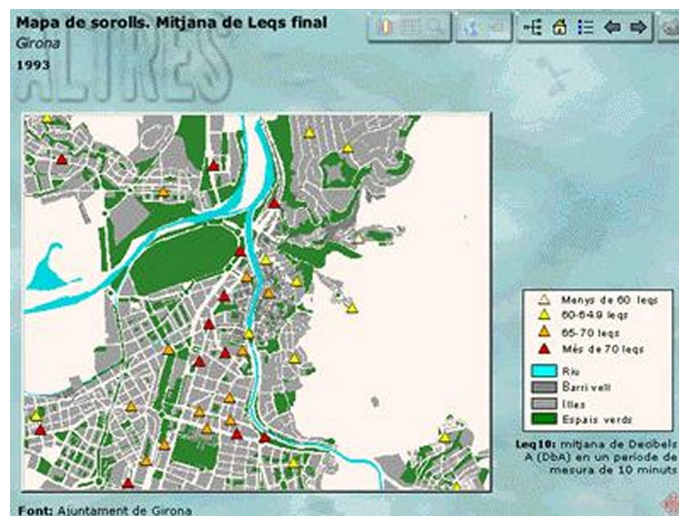


Figure 9.