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SOME RAILWAY NOISE PROJECT AFTER THE SENDING OUT OF THE NEW NOISE LOW DPCM 495/98

P. ROMANI*, A. MARTINO*, F. VENTURA**

* ITALFERR S.p.A., Via Marsala, 53, 00185, Roma, Italy

** V.D.P. S.r.l. Progettazione Integrata, Ambiente, via del Vascello, 24, 00152, Roma, Italy

Fax: +39 06 4975 2116

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ABSTRACT

According to the issuing of the new legislative decree DPR 459/98, Italian set of rules in railway field results to be aligned with the law 447/95.

As a consequence, new railway lines projects (both existing lines and High Speed lines) have been carried out by following these new criteria identifying pertinence zones and respective acceptable noise levels.

This document shows the differences between traditional and new design techniques, and some case studies.

Also the problems of direct mitigation interventions on receptors and traditional noise abating barriers, are shown.

On this subject, simulations and experimentation have been pursued. These simulations showed important results leading to the adoption of noise abating casings in low density zones and noise abating barriers in urban areas.

1. INTRODUCTION

In Italy, the question of railway traffic noise pollution has been dealt with organically, in terms of legislation, through the issue of detailed standards.

Indeed, as contemplated by art. 11 of Law no. 447 dated 26th October 1995, the "Outline Law on noise pollution", the decree implementing regulation noise produced by railways was issued on the 18th of November 1998 (DPR no. 459).

As a consequence, the criteria and methodology relative to the scale of works for the mitigation of noise produced by railway infrastructures has undergone a substantial revision.

The purpose of the revision was to check respect of the limits contemplated by the new standards at the same time as producing clear, easily interpretable documentation to provide the local authorities, and thus the citizens concerned, with information on the impact of the new lines planned and to assess the envisaged mitigating works.

2. THE STANDARDS

DPR no.459 defines standards for the prevention and mitigation of noise pollution generated by railway and surface metropolitan system infrastructures (the latter excluding trams and cable-cars.

These standards apply to existing infrastructures, variants of the same, new lines flanking existing ones, and completely new infrastructures.

They establish corridors of railway infrastructure territorial pertinence measured from the centre of the external rail on each side and with the following widths:

- 250 metres for infrastructures with speed rating not exceeding 200 kph. This corridor is divided into two parts, the first, nearest the railway infrastructure, of width 100 metres, denominated zone A, and the second, further away from the line, of width 150 metres, denominated zone B,
- 250 metres for infrastructures with speed ratings greater than 200 kph.

For existing infrastructures, variants to the same, new lines flanking existing ones and new infrastructures with design speed not exceeding 200 kph, the absolute limits for noise emissions within the corridor of pertinence are as follows:

- 50 dB(A) Leq diurnal, 40 dB(A) Leq nocturnal for schools, hospitals, nursing and retirement homes. For schools, only the diurnal limit applies
- 70 dB(A) Leq diurnal, 60 dB(A) Leq nocturnal for other receptors in zone A
- 65 dB(A) Leq diurnal, 55 dB(A) Leq nocturnal for other receptors in zone B.

For infrastructures with design speeds greater than 200 kph, the absolute limits for railway infrastructure noise emissions are as follows:

- 50 dB(A) Leq diurnal, 40 dB(A) Leq nocturnal for schools, hospitals, nursing and retirement homes. For schools only the diurnal limit applies
- 65 dB(A) Leq diurnal, 55 dB(A) Leq nocturnal for other receptors.

The observance of the above limits within and outside the corridors, and observance of the values established by DPCM 14/11/1997, is checked by measurements made over the whole reference period (day and night), at the face of the buildings, at 1 metre from the same and at the points of greatest exposure.
In cases where it is technically impossible to achieve the above values, or where technical, economic or environmental appraisals indicate the need to intervene directly on the receptors themselves, observance of the following limits must be ensured:

- 35 dB(A) Leq nocturnal for hospitals, nursing or retirement homes
- 40 dB(A) Leq nocturnal for other receptors
- 45 dB(A) Leq diurnal for schools.

Such interventions would be implemented on the basis of appraisals made by an Environment Ministry commission acting with the health and transport ministries, which would agree intervention with the Regions or Independent Provinces concerned within 45 days of presentation of the project.

3. ACOUSTIC DESIGN ACTIVITIES

The study method adopted in the preparation of acoustic projects is aimed at achieving the following objectives:

- to isolate the source of railway noise from all the other sources present (motorways, state highways, provincial highways, industry, etc.);
- to undertake a detailed survey within the study corridor of 250 metres per side, and up to 500 metres per side in the presence of schools, hospitals, nursing and retirement homes; in densely built areas, and with receptors positioned adjacent to the railway, the study is limited to within an area delimited by the noise level curve corresponding to the limits established by the standards;

- to identify any potential expansion of buildable areas within the study corridors already earmarked as such on Urban Development Plans, or generalised variants to the same;
- to generate a numerical models to forecast future levels of rail traffic induced noise, capable of considering the environmental propagation conditions that significantly influence the process of noise diffusion. These models allow the study corridor to be mapped without having to undertake extensive on-site surveys. The models can also be used to forecast future increases or decreases in rail traffic.

  The models used are suitably calibrated by on-site sound level readings taken in the vicinity of the more exposed receptors. In addition, experimental acoustic characterisation is undertaken on the various types of train envisaged for the new lines.

  These measurements are made at a horizontal distance from the railway centreline of 25 metres (or 7.5 metres) and at a height of 3.5 metres from track level, in compliance with DM 16.3.98 "Specification for measurements.

On the basis of the results given by simulations, and having made all the necessary confrontations with the limits set by standards, the scale of mitigation works required is determined indicating the type and characteristics of the same.
The technical characteristics of the infrastructure, the insertion of the line into the environment and the results of noise surveys are just a few of the parameters considered in determining the scale of noise barriers.
The variety of barrier types available on the market, their particular noise insulation or absorption characteristics, aesthetics and technical specifications, not to mention cost in terms of purchase, installation and relative foundation and maintenance, complete the designer's parametric frame of reference.
For all types, and in particular for those in r.c. and aluminium, specific architectural designs are drawn up defining form, colour and material alternation both of the panels and supporting structures, aimed at improving environmental insertion of the works in architectural/landscaping terms.
In particular, r.c. barriers require:

- adequate aesthetic/architectonic quality of the barrier system in its entirety according to the environmental quality of site crossed by the infrastructure;
- visible dialogue between the various structural and aesthetic elements, alternating their role according to the overall design and the surrounding environment;
- constructional variants to allow optimal insertion of elements even with differing material and geometry, to offer a range of configuration options;
- Prefabricated r.c. facing elements with surfaces either smooth and/or structured with the aid of colour and/or geometric variants.
- This kind of action is aimed at qualifying the design of the barriers and thus the infrastructure itself, not the other way round.

4. DIRECT WORKS ON RECEPTORS

One of the major innovations introduced by DPR 459 is the possibility of undertaking mitigating works directly on the receptors themselves.
In effect, this ruling envisages observance of internal limits measured in buildings with windows closed, in alternative to external noise limits.
This alternative may be adopted if the acoustic design reveals the need for works directly on receptors (mainly in terms of high insulation, self ventilating windows) based on technical, economic and environmental appraisals.
In particular, in the design of railway noise mitigating works, the following methodological criteria has been adopted:

- For receptors situated within the railway pertinence corridor in urban or suburban built clusters, indirect intervention is envisaged on the railway line with noise barriers to obtain the diurnal and nocturnal values established by DPR 495 of 18.11.98 along the external front. In such cases the significant aesthetic impact and cost of the mitigating works would be justified in that they serve to simultaneously protect groups of receptors.

- For the same category of receptor, where it is not possible to achieve mitigation targets by means of noise barriers, sound levels are measured internally and, if the limits contemplated by DPR 459/98 are not respected, mitigation works are performed directly on the building in question (substituting windows, etc.) to obtain and internal level of 40 dBA Leq nocturnal.
- For isolated receptors (individual buildings/houses and pertaining areas) for which the adoption of noise barriers is not justifiable for economic and environmental reasons, nor is of real acoustic effect, interior noise levels are checked and, if the interior limits of DPR 459 are not respected, intervention is made directly on the building itself, substituting windows to achieve an internal level of 40 dBA Leq nocturnal.
- For receptors destined for commercial or industrial use, observance of the contemplated noise limits is achieved by direct mitigating works. The scale of such works is determined by the interior diurnal (6.00 to 22.00) noise limit, equal to 45 dBa. An internal nocturnal (22.00 – 6.00) limit of 40 dBA is only applied if the relative activities extend into that reference period.
- For particularly sensitive receptors, such as hospitals, schools, nursing and retirement homes, situated within the railway pertinence corridor, works with noise barriers are scaled to achieve external values of 50 dBA Leq diurnal and 40 dBA Leq nocturnal, with schools being excluded from nocturnal limits.
- For the above type of receptor, where it is not possible to achieve mitigation targets by means of nose barriers, sound levels are checked internally and, if the limits contemplated by DPR 459/98 are not respected, mitigation works are carried out directly on the building in question, substituting windows, etc., until achieving an internal value of 35 dBA Leq nocturnal or, for schools, 45 dBa diurnal.

CONCLUSIONS

The Italian State Railways and Italferr in particular, are currently engaged in research to raise design standards for the new barriers to be adopted on new railway lines.
At present, between design and construction works in progress, Italferr is currently "dealing with" around one million square kilometres of noise barriers; a considerable number that demands a design approach aimed at improving the environmental quality of railway infrastructures.

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