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USING MONETARY VALUES OF NOISE FOR TRANSPORT POLICY DECISIONS: CURRENT PRACTICE AND FUTURE DEVELOPMENTS IN FRANCE

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ABSTRACT
This paper gives a historic view of the use of monetary value of noise in cost-benefit analysis of large transport infrastructure projects in France over the last 5 years. Further to recommendations given in 1994 by the National Planning Office, noise values are used by the National Road Administration since 1998 for new and modification of existing roads. A revision of the methodology as well as noise values are expected in 2000.

1 - INTRODUCTION

Taking into account the effects on the environment of the projects and policies of transport in the decisions is recent [1]. It raises the question of the integration of the environmental externalities, and in particular that of the noise, in economic calculation. From a theoretical point of view, noise values could be used for numerous types of economic decision related to noise issues: transportation scheme appraisal, compensation, pricing of infrastructure, noise abatement projects or policy, etc.
Until the middle of the nineties little search had been carried out in France on the valuation of noise whereas throughout the eighties, various valuation methods had been developed and applied in Europe, mainly in Scandinavian countries [2], in Germany [3] and in Switzerland [4], and that some recommendation were made as for the use of unit value of noise in the economic decision [5]
Only from 1994 an economic value of noise was recommended by the French government [6]. This value was taken again and brought up to date in 1995 in an official document from the French Ministry of Transport relating to methods for the economic appraisal of large transport infrastructure projects [7] then in 1998 in a document published by the National Road Administration concerning the methods of economic evaluation of road investments in open country [8].
In spite of this progress, taking into account noise issues in the economic decisions remains still insufficient. New proposals concerning the value of noise to be used in economic calculation as well as the field of application of the method are awaited into 2000, while at the same time the first results of the search launched in 1998 in this field will be available.

2 - THE FRENCH NATIONAL PLANNING OFFICE'S RECOMMENDATIONS

Noise valuation issues are discussed in the appendix 3 of the report published in 1994 by the French National Planning Office.
The adopted method is of type " top-down ". The principle of calculation is the following: the cost of the person annoyed by noise is obtained by dividing the total cost of noise of transport for France by the number of people annoyed by noise. The total cost of noise for France was estimated within sight of results available at the international level, that is to say 0.3 % of the GNP. The total number of annoyed people was obtained by using a dose-response relationship between the level of noise exposure and the percentage of annoyed people. For 1992 the value recommended by the French National Planning Office was thus estimated at 137 Euros/person annoyed/year.
Many criticisms can be brought to this approach. They relate as well to the method as on the data used for calculation:

- the total cost of noise retained for France (0.3 %) comes from an average of findings resulting from work undertaken in various European countries. However nothing makes it possible to say that this average cost is relevant for France. Indeed the total cost of noise depends largely on the national context: it is higher in the high noise exposed countries, much less in the countries where the noise is a minor problem or solved well by the implementation of a national noise abatement policy. The total cost depends also largely on the evaluation method used (house price depreciation, contingent valuation in particular) and of its implementation. But the evaluations carried out in Europe did not all use the same methods.
- the dose-response relationship used derives from Scandinavian work (Sweden and Finland). It had been more judicious to use the French data available. In addition the dose-response relationships used in the two Scandinavian countries are based on 24 hour noise exposures and not on daytime noise exposure as in France. The noise annoyance indicator used is not specified (% of highly annoyed, of annoyed in general?)
- the data of transport noise exposure used are inaccurate. They do not correspond to the French situation for the middle of the 80's.

For at least these reasons, it is not desirable that the value recommended in this report is used.

3 - ASSESSING THE COST OF NOISE ANNOYANCE: METHODOLOGY PROVIDED BY THE FRENCH MINISTRY OF TRANSPORT

Further to the recommendations of the French National Planning Agency, the Ministry of Transport provided in 1995 a rough methodology for the evaluation of the cost of noise annoyance to be used in cost-benefit analysis of large transport infrastructure projects. This methodology gives how to assess the number of persons potentially annoyed from the number of persons exposed to noise (daytime L_{Aeq}) and a noise exposure-annoyance relationship. The formula is the following one:

$$\text{Number of persons annoyed} = 0.75 \times N_{65} + 0.20 \times N_{60} + 0.05 \times N_{55}$$

Where:

- N_{55} = number of persons exposed to noise levels between 55 and 60 dB(A); 5 % of them are assumed to be annoyed.
- N_{60} = number of persons exposed to noise levels between 60 and 65 dB(A); 20 % of them are assumed to be annoyed.
- N_{65} = number of persons exposed to noise levels exceeding 65dB(A); 75 % of them are assumed to be annoyed.

The annual cost of the annoyed person retained for 1994 was estimated at 147 Euros (re-evaluation of the amount of 137 Euros recommended in the report of the French National Planning Office).
The number of noise exposure categories are insufficient. The method of calculation is completely insensitive to a decrease in the levels of exposure from 75 to 65 dB(A) for example. The percentage of people annoyed by category of exposure are to be re-examined within sight of the data available for France. The evaluation of the number of people annoyed by noise refers to the daytime exposure. In any rigour it would be necessary to also take account of the population annoyed at night.

4 - METHODOLOGY APPLIED BY THE FRENCH NATIONAL ROAD ADMINISTRATION

It is in its appendix 11 (Integration of certain effects on the environment) that this document describes the method of evaluation which makes it possible to take into account noise nuisances in the economic appraisal of road schemes. This method distinguishes:

- noise nuisances in the vicinity of the new road
- noise nuisances from the other roads whose traffic will be modified by the new road (induced effects)

This method distinguishes two other types of effects:

- noise nuisances that affect residents at home

- noise nuisances that affect outside areas

Only the first category of effects (buildings) are evaluated in monetary terms.
In the case of noise nuisances in the vicinity of the project, in so far as the levels of exposure in front of dwelling are lower than the regulatory noise limits, noise nuisances are considered to be internalised within the cost of the project (through the cost of noise protections), the possible residual annoyance being neglected.
On the other roads, whose traffic is modified by the new road project, the method is based partly on the document of 1995, in particular concerning the unit value of the annoyance (147 Euros/year/person annoyed). However the logic of calculation is somewhat different. Calculation relates to the value of the noise exposure (cost per decibel) and not of the annoyance, even if implicitly a noise exposure-annoyance relationship is used.
Certain simplifying assumptions were retained:

- it is considered that the cost of noise nuisances is zero below L_{Aeq} 60 dB(A) for daytime, below L_{Aeq} 55 dB(A) for night-time, levels of exposure corresponding to the limits for new roads
- it is considered that the valuation of the total noise nuisances (day and night) takes into account for half of the daytime noise nuisance and half of the night-time noise nuisance
- for each of the two periods considered, the difference between state 1 (without project) and state 2 (with project) is taking into account only if the level of noise exposure (L_{Aeq}) increases of more than 2 dB(A).

The method of calculation is the following one:
a) Valuing daytime noise nuisance B_d (6h-22h):

$$\begin{aligned} &- \text{ if } L_d \leq 60 \text{ dB (A)}, \text{ then } B_d = 0 \\ &- \text{ if not } B_d = 0.05 \times A \times (L_d - 60) \end{aligned}$$

A is the noise annoyance value i.e 147 Euros/year/person annoyed.
The variation ΔB_{d21} of the daytime noise nuisance valuation (between state 2 and state 1) is taken into account at the condition noise levels increase by more than 2 dB(A):

$$\begin{aligned} &- \text{ if } |L_{d2} - L_{d1}| \leq 2 \text{ dB (A)}, \text{ then } \Delta B_{d21} = 0 \\ &- \text{ if not } \Delta B_{d21} = B_{d2} - B_{d1} \end{aligned}$$

b) Valuing night-time noise nuisance B_n (22h-6h):

$$\begin{aligned} &- \text{ if } L_n \leq 55 \text{ dB (A)}, \text{ then } B_n = 0 \\ &- \text{ if not } B_n = 0.05 \times A \times (L_n - 55) \end{aligned}$$

The variation ΔB_{n21} of the night-time noise nuisance valuation (between state 2 and state 1) is taken into account at the condition noise levels increase by more than 2 dB(A):

$$\begin{aligned} &- \text{ if } |L_{n2} - L_{n1}| \leq 2 \text{ dB (A)}, \text{ then } \Delta B_{n21} = 0 \\ &- \text{ if not } \Delta B_{n21} = B_{n2} - B_{n1} \end{aligned}$$

The variation ΔB_{21} of the total road traffic noise nuisance cost (day + night) is:

$$\Delta B_{21} = \Delta B_{d21} + \Delta B_{n21}$$

This formula gives an annual cost per capita related to the changes of noise exposure. The total variation of the cost of the noise nuisances related to the project is the sum of the variations per capita for the whole of the inhabitants affected by the project.
With regard to the noise nuisances in the vicinity of the project, the method suggested does not make it possible to evaluate the monetarized benefits of the application of the noise regulation (i.e. the utility of the protection measures). It is limited to taking into account the costs of the protection measures making it possible to respect the noise limits.
In the case of the induced effects of the project on the existing infrastructures, in addition to the question already raised concerning the value retained for the annoyance, the method of calculation is not presented in a very explicit way. This method has however the merit to introduce the level of noise exposure at

night and not to put a upper value to the cost of the noise nuisance at 65 dB(A) as the document of the Ministry of Transport in 1995 did.
However noticeable improvements could be made to the method, in particular with regard to the form of the noise exposure-annoyance relationship implicitly used in calculation. Moreover the question of taking into account certain regulatory aspects (in particular residual annoyance) in the method of calculation can be discussed; the noise black spots situations are not considered.
Finally the method covers only road traffic noise nuisances. An adaptation of the method to the case of railway noise (taking into account the "rail bonus") and aircraft noise would be desirable.

5 - REVISING THE 1994' RECOMMENDATIONS

In 1999, the French National Planning Office created a new Working Group for the revision of the recommendations given in 1994. The report of the WG was completed in 2000. The new recommendations are as follow:

1. A better integration of noise concerns in transport projects is requested more and more by the community. Consequently recommendations of the National Planning Office given in 1994 have to be enlargened and revised in this way.

2. New recommendations and proposals apply to any source of noise emitted by means of transport, and always when the effects of noise are considered in decisions.

3. Revealed preferences method applied to the housing market (or hedonic pricing) provided a satisfying assessment of the cost of noise: each additional decibel decreases the value of real estate of 0.8 to 1 %.

4. The unit cost of noise deriving from hedonic price method has to be corrected for integrating long term effects of noise on health; it represents an estimate of the social cost of noise.

5. In the absence of a sufficiently defined layout, the first step of road projects and the transport schemes will be considered more basically using values per veh.km. depending on geographical and demographic characteristics of the areas affected by the projects.

6. Assessing noise costs applies not only to residential areas but also to commercial and industrial areas, public buildings and not built up areas yet.

7. Awaiting an in depth analysis, noise values provided by the hedonic price method differ from values currently used.

8. The unit costs of noise are varying with noise exposure levels. The lowest value applies to noise exposure levels inferior to 5 dB(A) to noise limits currently used; night period has to be considered apart.

9. Unit cost of noise has to be applied in average value to sufficiently large areas in order to establish the social acceptance of the noise valuation.

6 - CONCLUSIONS

Transport noise has a cost to the society. A considerable amount of money is spent every year by government and local authorities to reduce or limit transport noise. Unfortunately the financial resources dedicated to noise control are limited, so must be used in the most effective way possible. In France, few policy decisions related to noise concerns actually use an economic tool as cost-benefit analysis, although the economic analysis of noise now has a rather good rational basis [9]. Consequently, in order to introduce a more rational utilization of resources, the costing of noise pollution has to be developed and encouraged and its use promoted. This is the way France has been following for the last 5 years. The first need is a more rigorous application of existing valuation techniques. The second requirement is that valuation techniques and values provided by these techniques are acceptable to policy makers and the public.

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