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STRATEGIC ENVIRONMENTAL NOISE MANAGEMENT

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1. INTRODUCTION

There is increasing demand for the development of a National Noise Strategy in the UK. In part this has been precipitated by the European Commission's proposals, which effectively require a strategic response from Member States. And in part it is a consequence of an advocacy of sustainability; one of the core issues behind the Government's White Paper on the Future of Transport, 1998, which sets out new thinking on integrating transport with other aspects of Government policy. These issues have exposed the rather piecemeal development of and consequent lack of integration within the present UK system; and there is a widespread and growing consensus that, for transportation noise especially, a strategic approach is becoming increasingly necessary. The Royal Commission on Environmental Pollution [1,2], the NSCA [3,4], the CIEH [5], as well as the European Commission in its 1996 Green Paper [6], have all recently recommended, in one form or another, a more strategic approach than our present one

Nevertheless the possible development of an official strategy in the UK is only now beginning to be discussed, and there is no certainty that it will be taken forward. The aim of this paper, at this early stage, is to take a step back from the details of the UK's existing noise management framework, and to argue for attentiveness to the peculiar nature of noise as a pollutant - as compared with other widespread environmental issues such as air quality - and the implications of this nature for its effective management. Indeed, the comparison with air quality provides a convenient basis for this discussion since in 1997 the Department of the Environment published 'The United Kingdom National Air Quality Strategy' [7], in recognition of the need for a more strategic and integrated approach to air quality issues.

The discussion is broadly in three parts. Firstly, the analogy with air quality is explored, addressing the implications of important differences between the two fields. Secondly, a general form and objectives of a noise strategy are proposed; and thirdly, the implications of what may be termed 'knowledge restrictions' are discussed.

2. THE ANALOGY WITH AIR QUALITY

The UK Air Quality Strategy builds upon two trends. It elaborates the principles of sustainable development, attempting to break down barriers between environmental and developmental policy making; and it takes advantage of progress in understanding of air pollution and the tools required to deal with it. In a sense, a comprehensive framework for management of air quality thereby becomes both necessary and possible at the same time.

2.1 Parallels with Noise

Many of the principles upon which the Air Quality Strategy is based apply directly to noise.

1. Sustainability: There is no doubt that noise, like air quality, is a fundamental sustainability issue, with a similar requirement to encourage modes of operation which are sustainable in the long term. As the Air Quality Strategy says 'The thrust of the Government's sustainable development strategy is to embed environmental policies into other, wider policy considerations.

2. Transport management: The Government set out the following principles with regard to addressing air pollution from transport:
   - Reduction in source emissions
   - Tighter controls on the existing fleet, its management and operation
   - Development of environmental responsibilities by fleet operators
   - Changes in planning and transport policies which would reduce the need to travel and reliance on the car.

   The aim of the policy is to balance these principles in a cost-effective manner. The link with noise management is explicit in the case of the traffic management policy, one of the aims of which is to reduce noise levels in town centres.

3. Health and the environment: The Air Quality Strategy states that air quality is not just an issue of human health: it also affects the natural environment. In noise the parallel may be seen to be with the concepts of amenity and tranquillity. Although direct health effects are hard to demonstrate at lower levels of noise, a parallel may be drawn in terms of a spoiling of countryside and other tranquil areas.

4 Local management: The UK's sustainable development strategy acknowledged that good air quality was essential for health etc., but identified a key issue for sustainability as 'to manage local air quality especially in urban areas, and in particular to ensure that all relevant sectors – industry, transport, local authorities and the general public - contribute.' The same applies to noise. Local actions serve merely as palliatives in the absence of an over-arching strategy, but they are nevertheless a necessary complement to high-level strategy. The Air Quality Strategy acknowledges a significant local dimension to Air Quality, with hot spots likely to occur, and suggests that local air quality management best deals with them. It suggests that local authorities should periodically review and assess the air quality within their areas, including local monitoring and embracement of the principle of sustainable development in terms of traffic management and land use planning.

5. Effects-based approach: The Air Quality Strategy is fundamentally effects-based, i.e. its aims are set in relation to the established effects of pollutants on people. Ultimately, any meaningful noise strategy must seek to embrace the same principle.

2.2 Divergences

There is clearly in principle a good deal of synergy between the two issues, and a highly significant degree of potential crossover in their strategic management. However, air quality and noise diverge at important points:

1. Standards and risk assessment: The Air Quality Strategy adopts standards – defined levels which can be taken to avoid significant risks to health - in terms of pollutant concentration levels, as the basis for its objectives. For some pollutants, such as carbon monoxide, critical thresholds are identified below which effects are unlikely even in sensitive group populations. For others, where there are no clear thresholds, a reasonable judgement is made in relation to the best estimate of continuous exposure-response relationships. The Air Quality Strategy acknowledges the possibility of synergistic effects of pollutants in combination. But no evidence for such effects is found, and the interpretation is rather that the effects of mixtures

are additive. Consequently, the standards and objectives are set out on a pollutant by pollutant basis.
Noise does not lend itself to the establishment of standards in quite the same way. It is possible to point to the likelihood of direct health effects at high levels of exposure, but for the majority of the population the link between noise, quality of life and health is not clear.

2. Sensitive groups: Determining the effect of pollutants on sensitive groups, such as asthmatics, is a useful means of establishing safe standards of air quality for particular pollutants. Research reveals a wide disparity in individual susceptibility to disturbance from noise, and it may therefore be sensible to think in terms of a psychologically vulnerable group who could perform a similar role. However, there is no convenient *a priori* means of identifying such a group, against which to set standards. There is possibly an argument for setting some standards in relation to the needs of people with hearing and/or visual impairments, but in general the lack of a clear health link at many levels of exposure makes the justification for such an approach difficult.

3. Local contextual effects: The local effects of noise cannot be simply predicted in terms of exposure response relationships, except in the very broadest sense. This is because the effects of noise are psychological constructs, which will vary very significantly from one community to another, according to particular concerns and expectations. Similarly, the concept of amenity is very important in noise, and means that relatively low levels of noise can be highly damaging in certain situations: in destroying the tranquillity of the countryside, for example. The psychological dimension, which is of fundamental importance in considering the effects of noise, is entirely absent when considering the effects of air quality, except perhaps in relation to odour. For this reason, a health-effects basis for setting standards for noise exposure is more difficult to embrace.

4. The role of commerce and industry: These have a key role to play in the Air Quality Strategy, since a significant proportion of total emissions are from industrial sources. But industry is a less significant contributor to noise emissions, causing more localized effects.

5. Trans-boundary pollution: Long range air movement means international agreement on the management of certain trans-boundary pollutants forms a crucial part of the Air Quality Strategy. Such considerations do not generally arise in noise.

3. THE OBJECTIVE AND STRUCTURE OF A NOISE STRATEGY

The analogy with air quality suggest how noise likewise should be addressed in a co-ordinated way at every level of infrastructural planning and decision making, from high level strategic planning of roads, airports and railways, to local traffic management measures and planning decisions; in sympathy with economically and environmentally sustainable integrated transport policies. Notwithstanding the divergences discussed above, many of the instruments used in the Air Quality Strategy: national initiatives, local action plans, enforcement of best practice in relation to industrial and commercial noise, a local and national monitoring network and noise mapping, would all form valuable components of an effective overall strategy.

But any strategy needs first of all an overall objective or aim, the strategy itself being a plan of action towards that objective, aligning policy and regulation in relation to it. Thus the NSCA recommends firstly the establishment of a clear view of what should be achieved by noise policy, as a precursor to a more general framework to be put in place to make it happen. One might state the general objective of a noise strategy as simply: *'To minimize environmental noise within an economically and environmentally sustainable transportation, commercial and industrial infrastructure.'*

The procedures for the design and planning of such an infrastructure should then be rationalized so that they are always mediated in an appropriate way by the above aim; and the aim ultimately is achieved by ensuring universal consideration of the effects of noise in any existing or future scenario, as set against other equally valid considerations such as economic development, cost, safety etc. Furthermore, the rationalization of all systems for the management of noise must ensure that all sources of noise are addressed in a coherent and collective way.

3.1 Effects Basis

As with Air Quality, any successful noise strategy will need to be effects-based, i.e. formulated in such a way as to minimize the effects of noise, rather than noise *per se*. Thus the strategy must not only seek to moderate direct adverse effects, such as annoyance or sleep disturbance, but must also seek to promote amenity – the loss of which must be considered an adverse effect - in such a way as to preserve and extend pleasant environments wherever possible.

3.2 Stratification by Context

As the divergence from the air quality model makes clear, a noise strategy cannot support the adoption of absolute standards or targets framed simply in terms of percentage of the population exposed to particular noise levels, since this would indeed ignore important effects such as loss of amenity. Nevertheless, such targets may be the best policy in relation to high levels of noise, where direct health effects are demonstrable. The strategy may need to be stratified accordingly, to be sufficiently sensitive to the implications of different degrees of noise exposure in different situations. For example, a crude stratification may be imposed along the following lines, according to broad levels of noise and/or land uses:

1. **Low.** Mostly rural, demanding a particular emphasis on policies in relation to effects on amenity, including the protection of designated recreational and/or tranquil areas.
2. **Medium.** Mostly urban/suburban, demanding noise-sensitive zoning and planning etc. to minimize the effects of transportation and commercial activities.
3. **High.** Mostly urban and/or close to arterial roads, caused by high levels of road traffic or aircraft noise. Likely to demand specific amelioration measures, and possibly the adoption of absolute noise level standards where chronic health effects are demonstrable.

Overall targets within each stratum would need to be set and measured across a sufficiently sophisticated range of effects criteria, possibly including percentage of population exposed for the highest degrees of noise, and percentage of rural and other land suffering loss of amenity for the lowest levels.

For the majority of the population, exposed to medium levels of noise, a number of parameters will need to be taken into account in order to measure progress against adverse effects, but this will not be straightforward. The widespread effect of annoyance, for example, is difficult to measure directly and may be confounded by changing expectations. In fact it is possible that a strategy which successfully reduces environmental noise emissions may, by increasing public awareness, cause annoyance levels to increase. Indeed, this was one of the reported outcomes of the Darlington Quiet Town Experiment [8], where 'increased sensitivity to noise' may have occurred as a result of the traffic management and publicity schemes that were introduced.

4. KNOWLEDGE RESTRICTIONS

The challenge of developing sufficiently sophisticated indicators of effects, against which to set targets and measure progress and benefit, is a considerable one, but one which any successful environmental noise strategy must be prepared to meet. Much the same challenge faces the present EC initiatives. Unfortunately, there are a number of highly significant areas of weakness in the knowledge base which can be brought to bear on the development of a robust effects-based noise strategy.

4.1 Effects of Noise Sources in Combination

Despite much research effort over the years, there is still no generalized method for assessing the effects of noise sources in combination. For example, the recent recommendations for a system of environmental noise metrics made in the Dutch Health Council Committee's report [9] - which have carried great import in the context of the current European initiatives - are put forward on the basis that annoyance attributable to a specific dominant source is not greatly affected by the presence of another source. On the wider issue of deriving aggregation rules to allow such metrics to predict the general annoyance engendered by a combination of two or more sources, the committee holds fire and acknowledges the likely difficulty of such an undertaking.

4.2 Change Relations

The dose-response meta-analysis which forms the basis for the proposals in the Dutch report, in common with most noise-effect data, is concerned with response to steady-state noise environments. For this reason the proposed metrics are not intended to be applicable to situations where the noise environment is changing (or has recently changed) significantly. This severely limits the field of application of such metrics as predictors of adverse effects, since they cannot legitimately be applied to establish the benefits or disbenefits of alternative scenarios leading to changes in the noise climate except in the long term.

4.3 Context-Specific Effects

The traditional approach to the study of the effects of noise has been to examine the relationship between an index of noise exposure and an index of human response or attitude, averaged across individuals within a particular community or exposure group. But the importance of the particular context is clear when the results of studies are compared, often revealing wide divergences between particular community responses. Synthesis studies allow single relations to be distilled, but it is disingenuous to regard the results of such studies to be revealing of some 'underlying' relation. In fact, no way of taking into account (or even identifying) important contextual effects when predicting response of individual communities has been developed, which means that only very general predictions of community response are possible.

4.4 Indices of Amenity

There is no widely accepted means of establishing the effect of noise on amenity, yet for large areas of land it is loss of amenity which is likely to be the primary detrimental effect of noise. Particular land-use categorizations can be made, and sensitive areas identified, but a relatively sophisticated way of assessing potential enjoyment and expectation is likely to be necessary before the true effects of noise can be judged in this context.

4.5 Noise cost-benefit aggregation

Notwithstanding the lack of data on change relations, techniques such as noise mapping allow predicted differences in population noise exposure patterns to be examined as a function of various what-if scenarios, for example in relation to road routing. But there is little basis for trading off the costs and benefits (purely in noise terms) of alternative schemes. How does one establish the aggregate effect of, for example, a relatively large decrease in noise for a few individuals against a smaller increase for a greater number? And is it even sensible to try? Any noise strategy will necessarily be involved with establishing the relative costs and benefits of alternative scenarios, yet the general absence of absolute effects thresholds significantly problematizes such equations.

5. CONCLUSIONS

There is a growing and persuasive case for a rationalization of the UK system of noise management, and the development of an official strategy. The analogy with air quality is a valuable one for this purpose, but important differences between the two fields must be borne in mind, especially in relation to the way in which standards and objectives are formulated. The development of noise policies, both in the UK and throughout Europe, is likely to encounter real difficulties caused by the variegated nature of noise effects. Such complexities should not be ridden over rough-shod, but must be attended to with the sophistication they demand.

6. REFERENCES

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