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NOISE STRATEGY – EUROPEAN EXPERIENCE

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1. INTRODUCTION

The requirements of the Greater London Act 1999 for a London Ambient Noise Stategy, and the forthcoming European Union requirements for noise mapping and action plans have focussed attention in the United Kingdom on the development of noise strategies. Within the United Kingdom, noise strategies have not been developed for a city or urban area to date. The London Ambient Noise Strategy will therefore be the first in this country, and a large step forward for ambient noise control in the UK. The aim of this paper is to present information on some of the experience that has been gained in other European countries.

The United Kingdom, has lagged behind Northern European countries in assessing and mitigating environmental noise. The Birmingham noise mapping exercise is the first large scale noise mapping, to have been carried out in the UK. Previous 'noise mapping' work in the UK has generally related to development plans, with the noise maps considering road, rail, aircraft or industrial noise, but rarely a combination of sources. There have been noise insulation schemes around some of the major airports and noise barriers provided adjacent to a small number of existing roads, but there has been little in the way of a holistic approach to ambient noise control. However, in the last few years there has been action (prompted by the forthcoming EU Directive?), to move ambient noise control up the political agenda. One tangible sign of this is that the Government has recently set the Highways Agency the target of installing quieter road surfaces on 60% of motorways and trunk roads by 2010.

2. NOISE MAPPING IN EUROPE

Noise mapping has been carried out in many European countries since the 1980's. Germany, the Netherlands, Austria and the Nordic countries were at the forefront of noise mapping. Much of the software used across Europe for noise mapping has been developed in Germany. The software has developed to implement various national noise prediction methodologies and can also be integrated with GIS systems to use the results of the noise predictions to provide data on numbers of properties and people exposed to certain noise levels. This level of sophistication allows the effect of various noise mitigation strategies to be considered in terms of change of noise level for numbers of residents.

The mapping in Europe has varied from noise maps of individual towns or cities through to national maps for roads and railways. In the Netherlands, all towns with a population of more than 50,000 have a noise map. This allows tables such as Table 1 to be prepared.

Table 1 – Noise Exposure in Dutch Towns

Name of City	Number of Dwellings	Distribution of dwellings over noise classes in 1990 in dB(A), L_{dn}					
		<55	55-60	60-65	65-70	70-75	>75
Den Helder	24,900	79%	10%	9%	2%	0%	0%
Groningen	73,382	76%	9%	10%	5%	0%	0%
Hilversum	33,440	71%	13%	10%	5%	1%	0%
Eindhoven	79,000	72%	8%	13%	7%	1%	0%
Rotterdam	280,000	72%	5%	9%	11%	3%	0%
Den Haag	195,780	71%	4%	12%	12%	1%	0%
Amsterdam	326,046	68%	2%	10%	17%	2%	0%
Waalwijk	10,500	68%	8%	14%	10%	5%	0%

The above is a small sample of results from noise maps of 63 Dutch towns covering 63% of the population. The data has been used in the Netherlands to rank the towns in terms of noise exposure.

However, there is a large step from carrying out noise mapping to providing an effective ambient noise control strategy. This is one of the lessons that can be learnt from Europe. Noise mapping is fundamental to a successful ambient noise control strategy, but it is only the first step.

The provision of a noise map without an effective follow up noise strategy may actually increase dissatisfaction with ambient noise levels because hopes have been raised by the noise mapping that 'something will be done' about reducing noise. The cost of the overall strategy should be considered at the earliest stage. There are obvious costs associated with noise mapping, but these are likely to be a minor part of the overall cost of a successful ambient noise control strategy.

3. NOISE CONTROL STRATEGIES IN EUROPE

Strategic ambient noise control programs are not new in Europe. There have been programmes carried out over the last 15 years. These noise control programs have generally dealt with road and railway noise, often on a national or regional basis. There are few integrated city wide ambient noise strategies. We will look in more detail at a specific noise control program later on.

The European experience has been that noise mapping will generate much interest in ambient noise and will create expectations in residents that benefits will be provided in terms of noticeable reductions in noise levels. The first part of the strategy following on from noise mapping has to be that realistic targets need to be set for noise control measures and that a timetable is set out for carrying out work. Implicit in this is the requirement for adequate funding to be provided to carry out noise mitigation works.

In 1993 Professor Tor Kihlman presented his proposal for a comprehensive Swedish Action Plan against noise "Handlingsplan mot buller". The proposal presented - among others - a new guideline value for ambient noise of Leq 45 dB(A) and 75 dB(A) in workplaces. In addition, the importance of socio-economic calculations was presented. However no overall calculations were presented. As an academic, even the necessity of improving funding for research was stated. As far as we know, no actions have taken place. This might be due to the fact, that the proposed action plan will require too much funding.

Education of the public and business community is required to ensure the widest acceptance of the noise strategy. Residents need to be made aware that the strategy will not provide silence for them. The benefits that can be provided will be limited and the noise strategy will be a long-term programme of perhaps 10-20 years before widespread benefits can be demonstrated. It will also be necessary to demonstrate that an objective method of deciding on work priorities has been adopted, to answer questions such as whether funds are targeted at a few properties with very high noise levels, or a larger number of properties with lower noise levels.

Education will also be required because undoubtedly some of the noise control measures will be unpopular. Measures such as lower speed limits and routing of through traffic away from certain areas may not be popular with drivers and businesses.

Controlling noise from different sources on an equitable basis poses a number of challenges. There is evidence that people react differently to a similar level of noise depending on the source of the noise. Does any noise strategy attempt to take these variations into account? The authority responsible for implementing the noise strategy will have different amounts of control over the different noise sources. Noise from road traffic is most readily controlled because the roads will be controlled by local authorities or central government. In Europe, the railway infrastructures are generally state controlled, but different operators are involved. The infrastructure part of the noise attenuation measures can be centrally controlled, but emmission control will be part of a 'code of operation'. The situation in the UK in relation to railway noise is more complicated because of the division of responsibilities between bodies such as the Strategic Rail Authority and private companies such as Railtrack and the train operating companies.

The experience from Europe has shown that aircraft noise is likely to be the most problematic source to deal with in any ambient noise strategy. The first reason is the obvious fact that noise from aircraft in flight cannot be mitigated by simple measures such as noise barriers or speed restrictions. The other reason is the fact that airports compete with each other on a national basis and on a European basis. There is great competition between Heathrow, Amsterdam Schipol, Paris Charles de Gaul and Frankfurt airports to be the number one European airport. There is competition within England to be the second largest airport in the UK. There is competition between various European airports to be international freight hubs. These factors mean that there is strong economic pressure on the airports to grow, to increase the numbers of flights and to attract business from other European airports. The airports are therefore competing against each other in a way that can work against noise control if it is applied at a regional or national level. In the past couple of years, there have been plans put forward to limit night time flights at both Amsterdam and Brussels airports. These plans have been rejected by the national governments because of the potential impact on the airports and the economy. The recent conflict between the EU and the USA on restrictions on hush-kitted Chapter 2 aircraft, demonstrates that aircraft noise has a large international element.

4 EXAMPLES OF NOISE STRATEGIES

In Copenhagen a Traffic and Environment Plan was presented in 1997. The plan deals with all main environment issues: traffic and health, energy consumption and emission of CO_2, NO_x and HC, traffic noise, traffic safety, the visual environment and the barrier effect of traffic. The noise chapter points out focal areas in the city and some important attenuation methods: urban renewal and funds for improved sound insulation, physical planning, speed reductions and traffic management schemes. Further improvements of facilities for bicycles and public traffic are mentioned as important means along with noise screening and better road surfaces. Copenhagen has a favourable position in that more than 2/3 of the home to work trips are carried out by bicycle or the comprehensive network of public transportation. To keep this share a new Metro system is under construction.

Since 1985 the Danish National Railway Agency has run a noise control programme. The aim is to install noise control measures at all houses exposed to more than 65 dB(A)-24 hours along the main railway lines. The main control measures in areas with the highest noise impact are specially designed noise barriers mounted close to the track. In other areas grants of between 50 and 90% are offered to improve the sound insulation of facades to ensure lower noise levels indoors.

The annual budget is around DKK 10-20 million (approximately £1-2 million) and the average cost of control measures has been DKK 40. - 100.000 per house (£4-10,000) . Reductions of between 5 and 15 dB(A) have been achieved. The noise abatement programme is based on priority schemes ensuring that houses with the highest noise impact are given priority.

In 1986 the Danish Government and the National Railway Agency entered into an agreement on noise control. The National Rail Agency was permitted to allocate an annual budget starting in 1986 at DKK 12 Million for noise control measures. Highest priority was to be given to areas with the highest noise impact.

The annual budget for the works has been limited, and therefore, the control programme was expected to run for 15-20 years. It was foreseen that residents living close to the railway lines would be most concerned about receiving attenuation of noise levels at their property. Therefore, a strategy was laid down to manage the noise control measures properly and to ensure that all residents adjacent to railways were dealt with fairly and equally and to manage foreseen complaints.

The first task was to map the number of people exposed to noise above 65 dB(A). The Danish guideline value is 60 dB(A) 24 hours for railway noise. However, as we are dealing with present noise problems and new technology for rolling stock will reduce sound emission on average by at least 5 dB, the control programme only encompassed dwellings exposed to more than 65 dB(A) at the most exposed facade.

The first mapping was carried out in 1986. The results showed that 12,000 homes were exposed to noise levels above 65 dB(A), with a small number being exposed to noise above 75 dB(A). In 1997 the new fixed link across the Great Belt replaced the ferry service resulting in a sudden jump in traffic volumes. New rolling stock has been introduced and higher speeds have improved the service. The corresponding changes in the noise mapping were carried out in 1991 showing an increasing number of exposed people. Now the number of homes exposed to more that 65 dB(A) was 16.000. As budgets have not been increased the control programme is now expected to terminate in 2010.

The method used to decide which properties to provide with noise attenuation first, is illustrated by the two tables below.

20 homes	exposed to more than 75 dB
50 homes	exposed to 70-75 dB or
100 homes	exposed to 65-70 dB(A)

The table above illustrates a typical scenario. We decided to predict a Noise Number Index (NNI) for each section of track. The Noise Index is based on a Danish survey on dose-effect relations in 1982 showing the percentage of highly annoyed people when exposed to different levels.

$L_{Aeq,24h}$	NNI
60-65 dB	0,03
65-70	0,11
70-75	0,23
75-	0,38

Using this NNI the railway network was divided into homogeneous sections and sorted by NNI. The resulting list showed the nosiest sections and where to start. The list has been updated, but the main procedure has been kept until now. The most relevant noise reduction measure for each section has been discussed too. The main principle has been to attain the greatest noise reduction per DKK. The choice has been between barriers or grants to improve sound insulation of houses. As part of the strategy a calculation was made, showing that the use of noise barriers everywhere technically possible, would take a huge budget of more than DKK 2 Billion, while a sound insulation programme for all homes could be carried out on a budget of DKK 100 Million.

The strategy decided sets the maximum cost of barriers to 4-5 times of the costs of a similar sound insulation of the houses along the section. The strategy has resulted in approximately 40 km of noise barriers covering 1/3 of the exposed houses. The rest has been offered grants for sound insulation and approximately 40% of these have accepted.

The outcome of the first 15 years of the noise control programme 1986-2000 can be summarised in the table below.

Number of homes	Control measure	Total costs in Million DKK	Costs in DKK per home
3.800	38 km of barriers	133	35.000
2.100	Carried out sound insulation	39	19.000
3.700	Offered grants but refused		
5.900	**Noise reduction achieved**	**172**	**29.000**

5 CONCLUSIONS

The United Kingdom is having to catch up quickly with the state of the art of ambient noise mitigation strategies that exist in Northern Europe. The groundbreaking work that has been carried out in Europe does allow the UK to learn lessons and avoid 're-inventing' the wheel. In terms of noise reduction achieved, it will be a long time before the UK can match progress in some countries. However, there is no reason why the UK should not match or improve on strategies implemented elsewhere. The requirement for the London Ambient Noise Strategy, provides the opportunity for London to take a lead and to start changing the widespread impression of a 'noisy' city.