Proceedings of the Institute of Acoustics

BIRMINGHAM NOISE MAPS - A PROGRESS REPORT

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1. INTRODUCTION

This paper will describe progress with Birmingham's noise mapping project and recent developments in Europe that relate to noise mapping in general. In particular, the progress of European Commission (EC) Working Group 4 - Noise Mapping, of which the author is co-chair, will be discussed as the work of this group should soon start to influence the direction of all noise mapping projects.

2. THE EUROPEAN COMMISSION AND NOISE MAPPING

The EC published a Green Paper on Future Noise Policy in November 1996 (1). In this document it was suggested that noise mapping has the potential to be:

- An effective and relatively inexpensive method for the assessment of environmental noise.
- A means of presenting noise data to the public and politicians.
- A basic planning tool.

Since the publication of the Green Paper the original ideas and proposals, which received almost universal support across Europe, have been refined through a process of consultation and debate. It now seems likely that the EC will issue a two-step Framework Directive on the Assessment and Reduction of Environmental Noise later this year.

At this stage of events it also seems likely that in step 1 of this Directive, Member States will be required to carry out 'limited' noise mapping using existing national methods. The Commission believes that this will lead to:

- The assessment of current levels of noise exposure using existing national methods.
- The design of action plans for noise reduction where appropriate.
- The establishment of a database on current noise exposure at European level.
- The establishment of a framework for providing information on noise to the public.
- The development of further noise indicators and criteria.
- The development of a common noise assessment method.

Member States will be required to take the necessary measures to provide noise maps and action plans for 'urbanised areas' no later than 5 years after step 1 of the proposed Directive comes into force. 'Urbanised areas' mean areas, delimited by the Member States, which are characterised by a population of greater than 250,000 inhabitants and have a population density greater than 1000 inhabitants per square kilometre. It appears likely that in step 1 only transportation noise sources will be considered.

In step 2 the Directive will be revised or repealed. The proposals for this step, which will include a requirement for the use of a common method for noise mapping, rules and guidelines for such mapping and the determination of target values (noise reduction targets?), will be made no later than 5 years after step 1 of the original Directive comes into force.

3. WHAT IS NOISE MAPPING?

Noise mapping is fairly commonplace in many European countries mainly at local (city) level. In some of these countries local noise mapping is now required by law. It is important to appreciate that mapping can be carried out and presented in a variety of forms. The precise techniques employed will depend on the levels of accuracy and definition required for the intended use of the results. The precise form of presentation of the results will depend on the intended audience, e.g. politicians, the public or noise professionals.

Examples of noise mapping are:

- Simple maps of measured noise levels at spot locations.
- Colour coded lines, produced from measurements or calculations, representing kerbside road traffic sound levels and/or track side railway sound levels.
- Contour lines of sound imission levels from selected noise sources. The areas between the contour lines are often coloured in and colour coded for effective visual presentation.
- Contour lines of noise exceedance or noise conflict levels showing where noise limits are being exceeded.
- Contour lines showing the effects of noise on the inhabitants of an area. For example, maps showing areas of 'high annoyance' to noise or possible sleep disturbance.
- A database of sound imission levels, noise exceedance/conflict levels, or noise effects at noise sensitive properties.

Furthermore, mapping in its various forms can be derived for different periods of the day or night and by using different noise indicators, noise dose-effect relationships, calculation heights, calculation techniques and so on. As a result of all these possible variations, virtually every noise mapping exercise carried out in Europe to date has been unique. However, from the available evidence, it appears that cities which have produced noise mapping information have generally achieved some success in reducing the environmental noise exposure of their citizens (2). Such an exercise can be regarded as a watershed. When managed correctly, the event can generate the political commitment to resource environmental noise reduction. In addition, if mapping is carried out using modern interactive computer-based technology, these techniques can be used to model possible noise reduction initiatives and establish the likely costs and benefits. This permits the development of action plans for noise reduction.

4. PURPOSES OF NOISE MAPPING

The main purposes of noise mapping using modern techniques can be summarised as follows:

- To identify and quantify the scale of noise problems at local, regional, national and European level.
- To identify where the problems are occurring.

- To provide information to the public, politicians and noise professionals on the scale and location of these problems.
- To set realistic objectives for noise reduction.
- To make more effective use of local, regional and national planning procedures to control and reduce noise imissions from new/proposed sources, to protect new noise sensitive developments from existing noise sources, and to protect areas of tranquillity.
- To develop action plans to reduce noise imissions from existing sources.
- To monitor the effectiveness of planning procedures and action plans in reducing noise imissions.
- To monitor trends in environmental noise.
- To provide a platform for further research into noise and annoyance, noise and sleep disturbance and noise and health issues.

5. PROGRESS IN NOISE MAPPING BIRMINGHAM

For the last year Birmingham Environmental Services Department has been working with German acoustic consultants (deBakom GmbH) to produce 'state of the art' noise maps for the entire city. These maps have been made using LIMA Noise Mapping Software (provided by Stapelfeldt Engineering GmbH).

Birmingham has approximately 1 million inhabitants, covers some 330 square kilometres and has approximately 184,500 buildings in the city Geographical Information System (GIS) database. Consequently, this project is believed to be the largest and most comprehensive noise mapping exercise ever undertaken in one step. The project has received support from the Department of Environment, Transport and the Regions (DETR) who regard it as a pilot study for modern noise mapping in the UK through which guidance on good mapping practice will be produced for local authorities. A full technical report on the production of the Birmingham Noise Maps is currently being prepared for DETR.

At the start of this mapping exercise, several major decisions were taken. The most important of these are shown below.

- Sound imission contour maps would be produced.
- The contour bandwidth would be 5dBA.
- Separate day time (0700 to 23.00 hours) and night time (23.00 to 07.00 hours) maps would be produced in terms of L_{Aeq} (T) levels.
- Separate maps for each of the following sources would be produced:

  Road traffic.
  Rail traffic.
  Aircraft in flight.
  Some of the major industries.
- Separate day time and night time combined maps (of all the above sources) and "PPG24" Noise Exposure Category maps would also be produced.
- All maps would show 'free-field' levels.
- The calculation height would be 4 metres.
- Only roads with combined 2-way flows of greater that 2000 vehicles per 24 hours on a normal weekday would be modelled (880 kilometres of road in total).

- Average weekday traffic flows, compositions and speeds from the West Midlands Traffic Model would be used to calculate the sound imissions from roads.
- The sound imissions from railways would be determined from the weekday passenger timetable information and data on goods train movements. The latter would be sought from Railtrack plc.
- Industrial sound imissions would generally be based on measurements and in the first instance would be confined to 'major' industries.
- Aircraft sound imissions would be taken from the existing noise contour information produced for Birmingham International Airport plc.
- The scale of the maps would be 1:10,000 and the maps would be based on 10 metre by 10 metre grids.
- The sound propagation model used would be ISO 9613-2 (3) and local weather conditions would be taken into account.

At the time of preparing this paper most of the noise maps have been produced and are now being evaluated. Each map is approximately 2.7 metres high and 2.2 metres wide being made up from 38 individual A2 size sheets. Smaller versions of some of the maps on a scale of 1:30,000 have also been produced for display purposes, but obviously significant amounts of detail have been lost in the scaling down process

The mapping software along with all the data files have been successfully installed on Birmingham's computers, training in the use of this software has been undertaken and an English version of the software manual has just been received.

It is important to appreciate that the mapping package that has been acquired is an interactive tool. The maps can periodically be updated to account for new developments and the noise impact of proposed individual developments can be modelled, evaluated and hopefully minimised using the software.

Perhaps of even greater importance, is the fact that the data files can be altered and through this process the costs and benefits of various noise reduction scenarios can be fully evaluated in a serious attempt to reduce noise from existing sources in the city. Whilst these techniques have yet to be fully explored, the software has already been rerun for a small section of the M6 Motorway with vehicle speeds reduced by 20 miles per hour to predict the effect that this would have at nearby residential properties.

During the production of the maps, some assumptions and compromises had to be made. Also some unexpected problems were encountered. These will all be identified and discussed in the report which Birmingham is producing for DETR in conjunction with the Building Research Establishment. However, in general the project has run surprisingly smoothly even to the extent that Birmingham Airport supplied night time noise contours during the mapping exercise and these have been incorporated into the final maps.

6. FUTURE WORK ON BIRMINGHAM'S NOISE MAPPING PROJECT

Since the production of the maps some short term noise level checks have been carried out by Birmingham Environmental Services Department across the city both during the day and night. These have indicated 'satisfactory' levels of accuracy. Longer term validation checks are planned for the future. However, the next major step in developing the use of the sound imission data that

has been produced from the project must be to place this data in a GIS. Through this process a queriable database of sound/noise levels outside all noise sensitive properties in the city will be produced and an indication of the number of people living in properties where the external noise levels are unacceptably/undesirably high can be obtained. It will then be possible to fully examine and evaluate the costs and benefits of both strategic and local noise abatement initiatives.

7. PROGRESS OF EC WORKING GROUP 4 (WG4) NOISE MAPPING

The EC has set up a number of working groups on the perception of noise to help develop its policy in this field. Working Group 4 (WG4), which is specifically concerned with developing noise mapping, held its first meeting on the 5 September 1998 in Copenhagen, just prior to the landmark conference on EU noise policy. Since that date two further meetings have taken place. These have resulted in significant progress in some areas. In particular, a work programme for the first two years of WG4's life has been drawn up. This includes the following set of draft deliverables and out-turn dates:

1. The production of a report on the common objectives agreed by WG4 members. Report May 1999)
2. The development of a questionnaire on noise mapping and other related issues to be completed by officers from competent authorities in Member States. These officers will also be interviewed after receiving the questionnaire. A progress report on this research will be included in WG4 Annual Report 1. (Report November 1999).
3. An examination and investigation of the following subjects/issues by all members of WG4

- The target groups for noise mapping information.

- The noise sources that should be mapped and the source data required to carry out mapping of these sources.
- The type of computational model required for noise mapping (in collaboration with WG3 Computation and Measurement).
- The types of noise maps required.
- How the results of noise mapping can be communicated to the target groups through effective presentation.
- How to use noise mapping information to control noise from new developments (planning actions).
- How to use noise mapping information to achieve real noise reduction from existing environmental noise sources.
  (Report May 2000).

4. Carry out an in-depth evaluation of the results obtained from the questionnaire and the related interviews. Take these results and the results of deliverable number 3 into account and produce an initial framework for the provision of noise mapping guidelines. A report on this exercise will be included in WG4 Annual Report 2.
   (Report November 2000).

5. The production of WG4s work programme and deliverables for years 3 and 4.

Work has already started on the production of a common objective document that is likely to include some of the common concerns expressed by WG4 members at this stage in the process. Similarly, a draft schedule for the preparation and distribution of a questionnaire and the evaluation of the results from this exercise has been developed. These documents will be considered and evolved before the next WG4 meeting that has been provisionally arranged for the 27/28 May 1999.

8. CONCLUSIONS

The real objective of developing the EC noise policy initiative is to have, with a minimum of delay, coherent environmental noise policies across Europe in order to improve the quality of life and the health of citizens. These objectives will be achieved in practice by reducing exposure to unacceptably high and undesirably high levels of environmental noise and by identifying, protecting and in some cases creating quiet areas. The production of noise mapping information, similar to that currently being produced and developed in Birmingham, is seen as an integral and essential part of this process.

REFERENCES

1 Commission of the European Communities Green Paper 'Future Noise Policy'. Brussels 04.11.1996 Com (96) 540 final.

2 Noise Mapping. Experience in Germany and its relevance to the UK. Report for DETR by Environmental Resources Management. July 1998.

3 ISO 9613-2 Acoustic-Attenuation of sound during propagation outdoors - Part 2: General Method of Calculation. December 1996.

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