

Proceedings of the Institute of Acoustics

SOUND CONTROL FOR HOMES: THE RESIDUAL DESIGN PROBLEMS

John Miller, Acoustic Consultant

1. INTRODUCTION

Earlier this year, the Building Research Establishment (BRE) and the Construction Industry Research and Information Association (CIRIA) published Sound Control for Homes, an acoustic design manual with worked examples. The project was funded by the Department of the Environment and involved the amalgamation and updating of two earlier manuals, published by CIRIA:

Sound Control for Homes - A Design Manual (Bickerdike Allen Partners, 1986) and

Sound Control for Homes - Worked Examples (Wimpey Laboratories and Bickerdike Allen Partners 1987).

These manuals had been produced in response to the need identified in an earlier CIRIA project definition study for state-of-the-art advice on domestic sound insulation, presented in a practical, digestible form. In updating these them, the basic structure was retained and the scope expanded to cover regulatory requirements in Northern Ireland and Scotland and the contents were brought in line with the following documents which had been published since production of the original manuals:

The Building Regulations 1991, Approved Document E, 1992 Edition

The Building Regulations (Northern Ireland) Technical Booklet G, 1990

The Building Standards (Scotland) Regulations, Part H, 1990

Calculation of Road Traffic Noise, DoE & Welsh Office, 1988

BS 4142, Method of rating industrial noise affecting mixed residential and industrial areas, 1990

DoE Planning and Noise, draft Planning Policy Guidance (issued for comment, 1992)

The Environmental Protection Act, 1990

A major change which had to be accommodated was the inclusion of flat conversions in Approved Document E.

Proceedings of the Institute of Acoustics

SOUND CONTROL FOR HOMES: THE RESIDUAL DESIGN PROBLEMS

2. CONTENTS OF THE MANUAL

The manual is directed at architects but will be of use to other building professionals. It covers the following aspects of acoustic design in housing:

Appraisal of noise affecting a site

Planning to control external noise

Planning to control internal noise

Selection of appropriate forms of construction to control external and internal noise

Detailing for noise control

Part A, is a brief description of the physical principles of sound transmission and noise control. The emphasis is on simple, jargon-free text and clear illustrations. Formulae, graphs, tables and calculation procedures are included to the side of the main text, and are optional reading. Busy users are advised to use Part A for reference, as necessary, using a glossary of terms at the back of the manual to find the topic of interest.

Part B, Scheme Design, emphasises the practical planning measures which are available at project inception and provides a basis for selection of construction methods for separating walls and floors, partition walls and floors and the building envelope.

Part D, Detailing, gives specifications for a wide range of sound-insulating constructions, including all of the constructions which appear in the Building Regulations for England and Wales, Northern Ireland and Scotland. The manual is not restricted to these constructions, however, and specifications are given for a range of other internal divisions and elements in the building envelope. For each construction type, a design check-list and site inspection check-list is given and sources of further information are listed.

Part E, Worked Examples, addresses the most frequently encountered acoustic problems, covering site noise assessment, the design and construction of new dwellings, sound insulation in conversions and the resolution of noise problems in existing dwellings. The practical use of theory and formulae from Part A is illustrated in these examples.

Proceedings of the Institute of Acoustics

SOUND CONTROL FOR HOMES: THE RESIDUAL DESIGN PROBLEMS

3. THE RESIDUAL DESIGN PROBLEMS

Sound Control for Homes is designed to be complete and self-contained so as to provide the user with a reasonable basis for acoustic design. Sometimes a precise formula cannot be given or measurement data do not exist for a source or construction under consideration. In such cases, the manual offers approximations which will allow the user to proceed. Such approximations are presented without apology in the belief that it is better for the authors to offer guidance than to leave inexperienced manual users to make their own guesses. Some of the areas where further and better particulars would be welcome are listed below.

Environmental noise:

The manual sets out noise criteria for road traffic, aircraft, railways and industry. These must inevitably be viewed as tentative until the publication of a final version of the PPG on Planning and Noise.

An outline of Calculation of Road Traffic Noise is presented. An similar prediction method for the generation and propagation of noise from railways would be valuable.

The manual presents data for the sound attenuation associated with simple reflecting barriers only. The designer's options would be expanded considerably by the development of a simple design methodology for more novel barrier designs, such as absorbent barriers, double barriers, profiled and angled barriers.

Building envelope:

With the exception of glazing and windows, little measurement data exist for the sound insulation of elements used in the building envelope. Laboratory results for doors (whether for internal or external use) give little clue to their performance in the field. There has been relatively little published on the sound insulation of roofs and the authors have been unable to identify any sound insulation data for domestic cladding materials, including the very common 11" brick/block cavity wall.

The manual presents a simplified calculation method for the transmission of road traffic noise through the building envelope, by adopting a source spectrum shape based on urban road traffic. It is expected that this principle will be used in the European Standard which will replace BS 2750, though the source spectrum shape is likely to differ.

Where good sound insulation standards are required, it is usually necessary to keep windows closed and to find some alternative method of ventilation. The manual gives sound insulation data relating to three methods of ventilation; trickle vents, the use secondary glazing with staggered openings and the use

Proceedings of the Institute of Acoustics

SOUND CONTROL FOR HOMES: THE RESIDUAL DESIGN PROBLEMS

of extract units which meet the requirements of the Noise Insulation Regulations 1988. However, these are restrictive to the designer and further developments in domestic ventilation and cladding design would be welcome.

Internal divisions

Comparatively little is known about the field sound insulation performance of the masonry separating wall with independent wall linings (Approved Document E, wall type 3). Further field test data would be illuminating.

A simple procedure is needed for the evaluation of flanking transmission in domestic constructions.

The method of measurement of impact noise has long been criticised on the grounds that the standard tapping machine does not simulate real footsteps and the low frequency performance of carpets tends to be overestimated.

Complaints are frequently made regarding impacts and sources of structure-borne noise, other than footsteps. The banging of doors and kitchen cupboards and the structure-borne sound of switches and plugs is complained of by the general public, yet these matters are not addressed in Building Regulations.

The manual gives practical advice on the design of a "quiet room", i.e. a room which can be used for quiet study or noisy activity by one or more members of a household. Though such an initiative could make a contribution to the reduction of domestic noise complaints and appears to be very much in line with current thinking on housing design, the concept does not appear to have gained ground with house-builders who are apparently concerned only with complying with minimum standards as laid down in the Building Regulations.

Building services

Advice on the control of noise from domestic services still relies mainly on common-sense precautions, rather than on quantitative engineering procedures.

4. SUMMARY

Sound Control for Homes is designed to be a complete and self-contained acoustic design manual. In order to achieve this, it has been necessary to present estimates where no measurement data exist and approximations where no simple accurate design formulae have been developed. In areas such as barrier design and ventilation, solutions offered may be restrictive to the designer due to lack of development. The manual contains some initiatives which have not, as yet, been widely adopted due in part to the lack of the backing of regulations and standards.