DETAILING FOR ACOUSTICS

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The Architectural Press: London
Nichols Publishing Company: New York

First published in 1983 by
The Architectural Press Ltd, 9 Queen Anne's Gate,
London SW1H 9BY

ISBN 0 85139 794 8

Published in the USA by Nichols Publishing Company,
PO Box 96, New York, NY10024

Library of Congress Cataloging in Publication Data

Templeton, Duncan.
Detailing for acoustics.

1. Building—Details—Drawings.
2. Soundproofing.
3. Architectural acoustics. I. Lord, P. (Peter)
II. Title.
TH2031.T46 1983 693.8'34 83–8067
ISBN 0–89397–161–8

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Printed in Great Britain by
Biddles Ltd, Guildford, Surrey
using photosetting by Phoenix Photosetting, Chatham,
Kent

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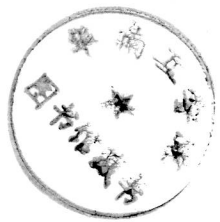


ACKNOWLEDGEMENTS

We are particularly grateful to the following:

Richard Cowell, Dr Judith Lang, Nils Jordan, Hadyn Bodycombe, and colleagues at BDP and University of Salford, Department of Applied Acoustics.

Material from CIRIA Report 88, 'Sound Insulation of House Separating and External Walls (with lightweight masonry for thermal insulation)' is reproduced by permission of the Director of CIRIA.

FOREWORD

Effective acoustic design—unfortunately still a Cinderella element of our architecture—depends heavily on detail. There are many references for guidance on the principles of good acoustic design, not enough tackling the details.

Here is a book which emphasizes details, and the authors set out to make it useful. Details, whether for sound separation, absorbent linings or impact isolation need to take due account of non-acoustic influences, and favourite solutions differ widely. Whether taken from product technical literature or prised from private collections these details represent a useful reference for all those involved with building.

I expect to refer to them often and hope they will help stimulate debate and development in a field where they are badly needed.

Richard Cowell
Arup Acoustics

There is paucity of practical material relating to architectural acoustics, compared with academic material dealing with the mathematics and physics of sound. This book is composed largely of guidance details intended for reference by architects, students, structural and services engineers and interior designers. Some knowledge of the theory of sound is assumed. Exhaustive coverage is not claimed, nor does the content replace the need for specialist aid. Component assembly and choice of materials are 'moving targets' and sheets could be added ad infinitum to this selection of standard and built examples.

Sources
Wherever possible laboratory test results have been obtained for the standard assemblies of materials: often the basic 'favourites' could be traced to a number of sources, with minor variations on a theme. Inevitably, for light partitions and ceilings in particular, manufacturers' information has been an important source of data. Such data should be treated with some caution as results may be given in the best light. The material presented has been checked as far as possible. Exact trade name specifications and references are given only where critical, as some products are subject to frequent change and development.

Format
The material comprises details of standard elements of building construction, assemblies of elements from projects and diagrams for assessing basics. Standard elements consider both sound insulation and sound absorption aspects. In the case of the former, a single value is normally given; for sound reduction, values are in the range 100 – 3150 Hz (with values listed for octaves, ie 125, 250, 500, 1000, 2000, and 4000 Hz). The scale of details as originally drawn is generally 1:5 unless noted otherwise, but all drawings are reproduced at reduced scale—use the drawn scale on each sheet for reference. Details of specialist components—eg suspended discs—illustrate specific usage and are not for copying on another project: we want to encourage dialogue with acoustic consultants, not replace it.

Content
The stated performance of the sound insulation of component assemblies is not intended to assign each a definite value. A particular assembly does not have a 'magic number' because its performance will depend on the context of use. Taking a partition type as an example, the sound insulation performance depends not only on its sectional constituents but on its size, degree of restraint at all sides, flanking effects and receiving room absorption. The values stated are only an average and two elements with the same average may have widely varying sound transmission at a particular frequency. For this reason, some important examples have their performance illustrated throughout the frequency range.

The single-figure values are to be used to provide a choice of comparable elements of construction, consistent in acoustical terms. A 'kit of parts' of elements can be put together where no part of the whole assembly is significantly weaker than the rest in performance. Doors and windows are problematic in that they are inherently lighter and gap-prone, but all is not lost when doors and windows are not up to the performance of the surrounding walls, floors and ceiling, and composite performance of assemblies can be assessed. A philosophy that the whole is only as good as the weakest link is analogous to components in a sound-reproduction system. Care in detailing junctions is particularly important where discontinuous construction details are used to achieve good sound isolation. Cost-cutting exercises through the design stage should not allow part of the 'kit' to be downrated to meet budget.

In the case of sound-absorption values, the figures should be used together with the tabulated values to sum the total effect of absorption in a particular space. In a large-area space, for example, an open-plan office, the characteristics of the ceiling and floor will be of particular concern.

Information can only reflect the current 'state of the art'. There are exciting developments in materials technology, for instance in the development of thin but very effective isolating membranes. In a future of

1 OBJECTIVES

lighter buildings and higher external noise levels, such materials could be a valuable asset to the designer.

Design process

For basic knowledge, use a primer text: eg the classic 'Acoustics Noise and Buildings', 4th Edition, Parkin, Humphreys and Cowell. The details we give here are intended to help at the practical rather than the crucial concept end of the acoustical design process. Stages of acoustical design input are summarized to show the total picture through a project. Acoustic consultants should be approached where a close check of characteristics is required.

1 Briefing

The client may state required standards in the finished building or, more likely, the functions stated dictate the fabric performance. Target criteria should be set at this stage.

2 Site selection

If a choice of sites is available noise sources may be included with other environmental criteria in a scoring matrix to determine the most suitable.

3 Noise survey

Background noise levels may be taken to assist brief-making studies or to determine the best position of a building on site. Quantification of adjacent noise sources may influence the design of the external envelope, in order to avoid noise intrusion.

4 Outline design

The form of the building may allow 'buffer' screening of sensitive spaces, and the arrangement of rooms may allow those requiring quiet conditions to be remote from noisy rooms, with fenestration limited and not facing any external noise source.

5 Detail design

In order that rooms can be sized to suit function and good aural reception, proportion, volume/occupant, reverberation time and surface geometry may be considered and adjusted. The quantity, shape and specification of finishes may be made optimal to required sound reflection, diffusion or absorption properties. The required separation between rooms or to outside noise is designed-in by each element having adequate sound insulating properties. Noise-control standards for services should be compatible with fabric-design standards: air-conditioning systems, plumbing, lighting, generators and switchgear plant are frequent noise culprits in large buildings. Design of specialist sound systems to suit the acoustics of the spaces is finalized at this stage.

6 Supervision

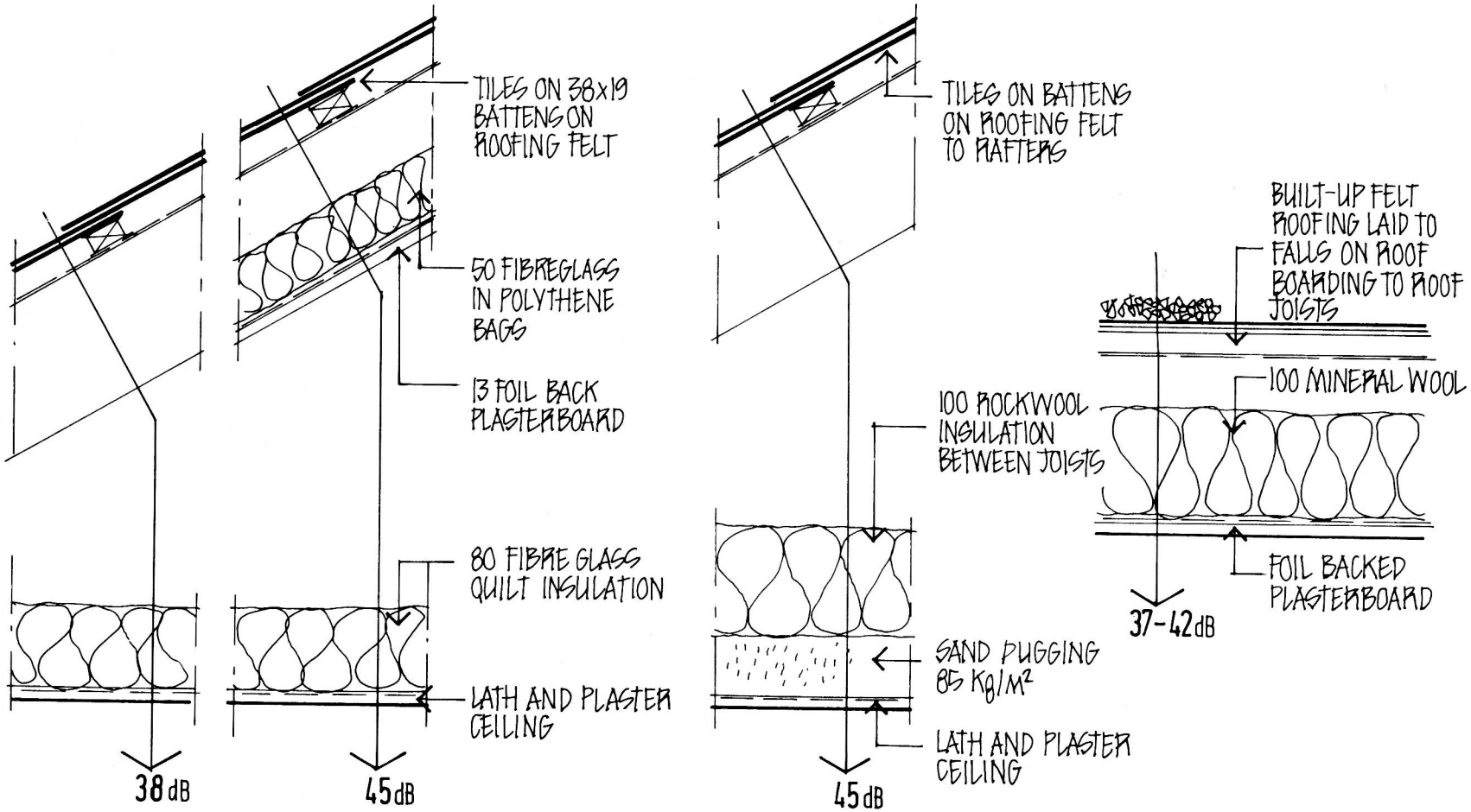
Care must be taken in getting many of the assemblies shown built properly, as some principles go against the grain of normal building practice—discontinuous construction at junctions and cavity walls with no ties will tempt the average contractor used to tying the whole lot together for stability.

7 Commissioning

Testing and tuning of services systems and sound systems and checking that sound insulation standards are provided in practice are advisable as the logical follow-up to care in detailing.

2 DETAILS

ROOFS



STANDARD DETAILS

ROOFS