

POCKET
ARCHITECTURE:
TECHNICAL
DESIGN SERIES

ANA M. JARAMILLO
AND CHRIS STEEL

ARCHITECTURAL ACOUSTICS

ROUTLEDGE



**Pocket Architecture:
Technical Design Series**

Architectural Acoustics

Ana M. Jaramillo and Chris Steel

First published 2015

by Routledge

2 Park Square, Milton Park, Abingdon, Oxon OX14 4RN

and by Routledge

711 Third Avenue, New York, NY 10017

Routledge is an imprint of the Taylor & Francis Group, an informa business

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British Library Cataloguing-in-Publication Data

A catalogue record for this book is available from the British Library

Library of Congress Cataloging-in-Publication Data

Jaramillo, A. M., 1979–

Architectural acoustics / A.M. Jaramillo and C. Steel.

pages cm. — (Pocketarchitecture : technical design series)

Includes bibliographical references and index.

1. Architectural acoustics. I. Steel, C., 1975- II. Title.

NA2800.J37 2014

729'.29—dc23

2014015304

ISBN: 978-0-415-73213-0 (hbk)

ISBN: 978-0-415-73214-7 (pbk)

ISBN: 978-1-315-75284-6 (ebk)

Typeset in Goudy and Univers

by Keystroke, Station Road, Codsall, Wolverhampton



Printed and bound in Great Britain by
TJ International Ltd, Padstow, Cornwall

Series Editor's Preface

Although architects and building professionals come into contact with, specify, design, and build technical practices every day, they actually know relatively little about them. They are “abstract systems” construed and constructed upon industry norms passed through generations of professionals. Most of them correct, but many, when disassociated with their cultural underpinnings of building vernacular and, more importantly, their scientific basis and practice contexts, present challenges that cause buildings to not perform as intended or worse lead to physical, economic, or social catastrophe.

PocketArchitecture: Technical Design Series fills this void. The series comprises succinct, easy to use, topic-based volumes that collate in one place unbiased, need-to-know technical information about specific subject areas by expert authors. This series demystifies technical design criteria and solutions. It presents information without overlaid theory or anecdotal information. *PocketArchitecture* is on point.

As the name would suggest, the volumes in this series are pocket-sized and collectively serve as a knowledge base on technical subjects in architecture, creating a value-added information base for building novices and masters alike. In addition to architects, engineers, and contractors that deliver building projects, the series is appropriate for students and academics interested in accessible information on technical information as it relates to building design and construction.

Despite their size, the series volumes are highly illustrated. Furthermore, the volumes use easily accessible language to succinctly explain the fundamental concepts and then apply these basic ideas to cases of common issues encountered in the built environment. *PocketArchitecture* is essential, accessible, and authoritative. This makes it important reading for architectural technologists, architects, building surveyors, building commissioners, building engineers, other construction professionals, even owners and clients.

This volume, *Architectural Acoustics*, addresses a pithy non-visual building science subject that is often misunderstood by designers. The book is focused on developing a basic understanding of why acoustical design is important and provides rules of thumb for how to accomplish auditory optimization. Hearing greatly impacts our perception of the world and our experience of architectural space. Poor acoustical design has tangible social, environmental, and health implications that are not well understood by most architects. Knowledgeably designed acoustics can enhance the user function of architecture, and can improve our physical wellbeing. *Architectural Acoustics* provides the fundamental theory and understanding of acoustics and applications of effective detailing for specific building types and conditions in an accessible and clear technical guide.

Ryan E. Smith
Series Editor

Acknowledgments

Chris Steel would like to thank Lee Hadden and Lenka Kovacova for their invaluable contribution in the production of the technical drawings, Professor Sean Smith, Professor Sam Alwinkle, Dr. Dave Baker OBE, and Peter Wilson, for reviewing the initial proposal and some of the later chapters.

Ana Jaramillo would like to thank Ricardo and Amparo Jaramillo for being, as always, the first critical reviewers of the work.

Finally both authors would like to thank Ryan Smith for helping to set up and edit the final publication.

"The science of acoustics as applied to buildings is complex and, worse still for the architect, surveyor and engineer, often apparently counter-intuitive. *Architectural Acoustics* lifts the lid on the subject, clearly explaining the underlying principles and setting out useful and practical solutions for dealing with noise in all types of building. It should be the essential reference source for those involved in the design and delivery of new buildings and will be equally valuable to those working in the field of refurbishment and building alterations."

*Dave Baker OBE, HonDEng, FRICS, FCIQB,
Chief Executive, Robust Details Limited, UK*

Introduction

Architectural acoustics is a subject that is often overlooked by architects and designers, as it may be portrayed as esoteric or considered less important than other design requirements. When a project requires an acoustics report, design teams may ask, “Why are we doing this?” The truth is that good acoustic design is as much a key element of good building design as the consideration of lighting or thermal comfort. It is no exaggeration to state that almost every type of building can, and should, include some consideration of acoustics if the goal of the architect or designer is to create a building in which people feel comfortable and can function.

There can be very real social, economic, and environmental consequences when architects and designers fail to take cognizance of acoustics in buildings. Our hearing is a 24-hour, 360-degree field of experiences and as such impacts greatly our perception, even when we are sleeping; therefore, noise or unwanted sound can have a profound effect on the human body. The effects of even relatively low levels of noise can have a detrimental effect on our physical wellbeing. The World Health Organization considers noise to be a more likely contributor to poor health and early mortality than damp housing and indoor radon gas. Be assured, unnecessarily noisy environments can be a hazard to health but the issues associated with acoustic design go beyond just controlling very noisy environments such as commercial or industrial buildings.

The failure to provide good acoustic detailing when creating new offices for, say, a legal firm or doctors’ practices can readily result in a problematic loss of confidentiality making the building unusable. An inability to fully understand the very particular acoustic performance parameters set by hotel or cinema chains will result in the very real risk of having to deal with a client who will refuse to take ownership of the building. Forget to consider

noise breakout when working on a new restaurant or retail outlet, and don't be too surprised if the result is a temporary closure, resulting in mounting remedial costs and a substantial loss of earnings to the client. These are not just examples of theoretical outcomes; they are actual events that have happened to major well-known firms over the past two decades.

Good architectural acoustics should not, however, be seen as something we do just to avoid risk. It can just as easily result in significant rewards for the client, designer, and building users. Good architectural acoustics within teaching environments can help to improve the educational attainment of the students who use the building. The thoughtful acoustic design of hospital buildings has been shown to improve patient recovery times and even reduce medication requirements and readmittance rates. Good acoustic design in the workplace has been shown to improve office worker productivity and increase retail sales. All of these benefits are the result of the built environment created by the architect or designer, often with the help of an acoustics expert.

The application of good acoustic design can seem daunting when trying to understand the often-complex physics of sound control or negotiating the ever-expanding canon of acoustic performance requirements, but even with a basic understanding of architectural acoustics it is possible for the most obvious of mistakes to be avoided and good design to become second nature.

The purpose of this book is to provide the architect, designer, contractor, technician, or student with a basic understanding of architectural acoustics. To provide a working knowledge of how sound affects a building and how it is controlled. To highlight the key acoustic design features and targets in a range of building types while providing a toolkit of information that can be referred to whenever a new project is undertaken. We have attempted to keep the mathematical explanation of sound to a minimum and focus on a narrative explanation of acoustics. This book is designed for those looking for the practical rather than the theoretical; however, for those interested in a deeper understanding the core equations for buildings acoustics are included as Appendices to the main text and referenced where necessary.

The first part of the book assumes that the reader is coming to acoustics from a fresh perspective and so tries to explain the basic concepts in a concise manner, focusing on some of the key knowledge required in architectural acoustics. The second part focuses on the design of particular building types

and, rather than showing case studies – which can often result in information which is project-specific – it provides a systematic guide to good design, highlighting the most common acoustic problems and offering guidance. The information in the second part of the book is bolstered by the technical specifications included in the Appendices, to allow for quick referencing.

PocketArchitecture: Architectural Acoustics hopes to provide the fundamental theory, practical application, and key design tools required for good acoustic design in an accessible and clear format.

Contents

<i>List of figures</i>	ix
<i>List of tables</i>	xiii
<i>Series Editor's Preface</i>	xvii
<i>Acknowledgments</i>	xix
<i>Introduction</i>	xxi

PART 1 PRINCIPLES 1

Chapter 1 Basic concepts 3

1.1 Speed of sound [C]	3
1.2 Sound pressure [P]	4
1.3 Frequency [f]	4
1.4 Period [T] and wavelength [λ]	7

Chapter 2 Interaction of sound wave and medium 10

2.1 Reflection	11
2.2 Diffraction	14
2.3 Scattering	14
2.4 Transmission	15
2.5 Absorption	27

Chapter 3 Human hearing 36

3.1 Sound perception	36
3.2 Loudness	37

3.3	Binaural hearing	39
3.4	Sound masking	43
Chapter 4	Noise	44
4.1	External and internal performance criteria	44
4.2	External noise control	46
4.3	Internal mechanical noise control	64
Chapter 5	Room acoustics	69
5.1	Geometrical acoustics	69
5.2	Reverberation	71
5.3	Early Decay Time, EDT	79
5.4	Signal to noise ratio, SNR	81
5.5	Speech intelligibility	83
Chapter 6	Sound measurements	85
6.1	The decibel (dB)	85
6.2	Weighting curves	86
6.3	Common environmental noise descriptors	87
6.4	Sound insulation performance parameters	88
6.5	Noise rating	95
PART 2	APPLICATIONS	99
Chapter 7	Educational buildings	101
7.1	The importance of good acoustics in educational building design	101
7.2	Performance criteria	101
7.3	Design guidelines	103

Chapter 8 Healthcare	122
8.1 The importance of good acoustics in healthcare design	122
8.2 Performance criteria	122
8.3 Design guidelines	126
Chapter 9 Offices	138
9.1 The importance of good acoustics in office design	138
9.2 Performance criteria	139
9.3 Design guidelines	142
9.4 Guidelines on specification	148
Chapter 10 Theaters/Auditoriums	153
10.1 The importance of good acoustics in theaters and auditoriums	153
10.2 Performance criteria	153
10.3 Design guidelines	155
Chapter 11 Concert halls	159
11.1 The importance of good acoustics in concert halls	159
11.2 Performance criteria	159
11.3 Typologies	161
11.4 Variable acoustics	163
11.5 Design guidelines	168
Chapter 12 Dwellings	170
12.1 The importance of good acoustics in the design of homes	170
12.2 Domestic sound insulation performance requirements	170
12.3 Building layout	171
12.4 Specifying acoustic treatments	177

Chapter 13 Commercial	182
13.1 The importance of good acoustics in commercial buildings	182
13.2 Performance criteria	182
13.3 Design guidelines	185
 Chapter 14 Hotels	 199
14.1 The importance of good acoustics in hotels	199
14.2 Performance standards	199
14.3 Design guidelines	202
14.4 Specifications for controlling reverberation times	208
 Appendix A – Design tables and equations	 210
A.1 Frequency and wavelength of sound	210
A.2 Sound pressure and sound power	210
A.3 Room acoustics	214
 Appendix B – Performance criteria	 223
 Appendix C – Performance specifications	 242
C.1 Absorption	243
C.2 Insulation	247
 <i>Index</i>	 251

Figures

1.1	One octave in music and acoustics	5
1.2	Octave and 1/3 octave bands	6
1.3	Sound spectrum	8
2.1	Incident wave's energy is being distributed between reflection, transmission, and absorption phenomena	10
2.2	Angle of sound entering is equal to angle of sound exiting when panel is two to four times the size of the sound wave acting upon it	11
2.3	Focalization of sound reflections due to a concave wall	12
2.4	Concave ceilings	13
2.5	Diffraction of noise around a barrier	14
2.6	Sound wave scattered in multiple directions due to a convex surface	15
2.7	Basic sound transmission	15
2.8	Profiles in concrete decks or heavy mass materials between joists improve stiffness	18
2.9	Resonance dip of two walls with the same mass but different constructions	19
2.10	Isolation	21
2.11	Critical frequency or the coincidence effect where grazing sound waves coincided with the surface waves on a panel	22
2.12	Flanking transmission paths	25
2.13	Methods of controlling flanking sound transmission	26
2.14	The three most common absorber types	29
2.15	Acoustic absorbers and their frequency performance	31
2.16	Noise reduction as a function of increasing absorption	34
3.1	Human audible range	36

3.2	Equal loudness contours	38
3.3	Binaural hearing	40
3.4	Displacement of the localization of the source	41
3.5	Reflectogram	42
4.1	Barrier block (residential or commercial) used to protect dwellings from noise source (in this instance, a road)	47
4.2	Minimum height barrier should extend over receiver height to ensure line of sight is broken (assuming comparable ground level between source and site)	49
4.3	Barrier arrangements	50
4.4	Using barriers to break horizontal line of sight either by a long barrier or a wraparound barrier	52
4.5	Optimum large building layouts to protect façades from noise, e.g., where road noise is the source	54
4.6	Protective balconies/terraces	56
4.7	Using fin walls and angled glazing to protect rooms from a noise source (e.g., road)	58
4.8	Three-story house where noise-sensitive rooms are on one façade	59
4.9	Flat/apartment where noise-sensitive rooms are on one façade	60
4.10	Central system (remote fan/compressor) mechanical room layout	66
5.1	Absorbing and reflecting sound-path differences	70
5.2	Reverberation time	73
5.3	Distribution of absorptive materials	77
5.4	Double slope reverberation times	80
5.5	Permissible ambient noise levels dependent on distance from speaker (normal speech L_{Aeq} 65 dB)	82
6.1	Weighting curves	86
6.2	Relationship between sound insulation of a partition and ambient noise level	94
7.1	Possible building layout where road noise is an issue	108
7.2	Through-the-wall natural ventilation (not to scale)	110
7.3	Natural cross-ventilation	111
7.4	Correct method for large M&E services	113
7.5	Non-standard-shape music practice rooms	119
8.1	Heliport location	127
9.1	Suggested office outline with comments on the acoustic features	144
9.2	Optimum office floor-plan layout	145

9.3	Section through an open-plan office	147
9.4	Electrical and ventilation/heating detail	149
10.1	Optimum reverberation times for speech by room volume	154
10.2	Good guidelines for lecture/seminar/theater space	157
11.1	Optimum reverberation times for music venues	160
11.2	Concert hall typologies	164
11.3	Turning panels	165
11.4	Sliding panels	165
11.5	Perforated sliding panels	166
11.6	Hanging panels in Troy Music Hall (Troy, NY)	167
12.1	Steps and staggers	174
12.2	Avoiding sensitive adjacencies in multistory buildings	175
12.3	Handling of adjacent rooms	176
12.4	Section – remedial acoustic ceiling treatment of masonry-supported timber floors	178
12.5	Section through floor/wall junction – good detailing practice for timber kit separating floors	180
13.1	Possible bar/club layout for controlling high noise levels	187
13.2	Acoustic entrance lobby	190
13.3	Cinema wall detail, auditorium to auditorium	196
13.4	External wall detail for cinemas, auditorium to outside	197
14.1	Place doors in corridors away from entrance to guest bedrooms	205
14.2	Optimum hotel bedroom layout	206
A.1	Attenuation of sound by a barrier	214
A.2	Panel absorber	219
A.3	Cavity absorber/resonator	220
C.1	Masonry wall specifications	247
C.2	Metal stud-wall specifications	248
C.3	Timber stud-wall specifications	249
C.4	Masonry floor specifications	250