

ARCHITECTURAL SCIENCE REVIEW

Volume 50, Number 3, September 2007

Contents

Vale Professor Henry Jacob Cowan Gary T. Moore	195
Structural Developments in Tall Buildings: Current Trends and Future Prospects Mir M. Ali and Kyoung Sun Moon	205
Applying Natural Ventilation for Thermal Comfort in Residential Buildings in Singapore Wang Liping and Wong Nyuk Hien	224
Identifying Streetscape Features Significant to Well-Being Arnold R. Spokane, Joanna L. Lombard, Frank Martinez, Craig A. Mason, Deborah Gorman-Smith, Elizabeth Plater-Zyberk, Scott C. Brown, Tatiana Perrino and José Szapocznik	234
Southern Drift: The Learning Styles of First- and Third-Year Students of the Built Environment Richard Tucker	246
Tile Renovation of Exterior Walls for the Taiwan Governor's Office Jih-Shong Wu and Ren-Jye Dzung	256
Removing Unwanted Heat in Lightweight Buildings Using Phase Change Materials in Building Components: Simulation Modelling for PCM Plasterboard Christopher Kendrick and Nicholas Walliman	265
A Case Study Survey of Harmonic Currents Generated from a Computer Centre in an Office Building Ming-Yin Chan, Ken KF Lee and Michael WK Fung	274
Space Planning and Energy Efficiency in Laboratory Buildings: The Role of Spatial Activity and Temporal Diversity Filbert Musau and Koen Steemers	281
Book Reviews H.J.Cowan (Book Review Editor)	293



The University of Sydney

Architectural Science Review Volume 50.3 (2007) pp. 195-298

Architectural Science Review

Founding Editor: Emeritus Professor H J Cowan AO (1919-2007)

50.3

The University of Sydney

ARCHITECTURAL SCIENCE REVIEW

Aims and Scope: Published continuously since 1958, *Architectural Science Review (ASR)* is the leading international refereed journal devoted to the science of architecture and the built environment. *ASR* welcomes submission of original research papers, shorter research notes, and abstracts of PhD dissertations and theses in all areas of architectural science including building science and technology, the environmental sciences, environmental sustainability, structures and materials, audio and acoustics, illumination, thermal systems, building services, building climatology, building economics, ergonomics, history and theory of architectural science, and the social sciences of architecture and the built environment. *ASR* encourages submissions from all countries. All research papers, research notes and review articles are double-blind refereed by a distinguished international Editorial Advisory Board or other experts in the field. *ASR* also publishes occasional invited review papers and editorials, and extensive book reviews.

Editor-in-Chief

Professor Gary T Moore, *RAIA PIA FAPA*, Professor of Environment-Behaviour Studies, The University of Sydney

Founding Editor

Emeritus Professor Henry Jacob Cowan, *AO*, 1919-2007, Late Emeritus Professor of Architectural Science, The University of Sydney

Associate Editors

Dr David Gunaratnam, Associate Editor (Structures)

Dr Simon Hayman, Associate Editor (Environmental Sustainability)

Associate Professor Warren Julian, Associate Editor (Environmental Sciences)

Honorary Associate Professor Peter Smith, Associate Editor (Building Sciences, Technology and Economics)

Book Review Editor

Emeritus Professor H J Cowan

Publications Officer & Editorial Assistant

Sue MacLeod

Subscription & Accounts Officer

Kim Pagett

Web and Research Assistants

Leilei Xu & Mozammel Mridha

Editorial Advisory Board

Dr Mohamed Abdel-Kader, Department of Architecture, Planning and Urban Economics, Cairo University, Egypt

Professor Mir M Ali, Structures Division, School of Architecture, University of Illinois at Urbana-Champaign, USA

Dr Richard M Aynsley, Research and Development, Delta T Corporation, Lexington, USA

Professor Chew Lit Yin, School of Design, National University of Singapore, Singapore

Professor W K Chow, Department of Building Services Engineering, Hong Kong Polytechnic University, China

Professor Arza Churchman, Faculty of Architecture and Town Planning, Technion Institute of Technology, Israel

Professor Gary Evans, Department of Design and Environmental Analysis, Cornell University, USA

Dr Marjanna de Jong, School of Teacher Education, Malmo University, Sweden

Professor Paul Fazio, Building Performance Laboratory, Centre for Building Studies, Concordia University, Canada

Professor Robert Gifford, School of Environmental Studies, University of Victoria, Canada

Professor Reginald G Golledge, Department of Geography, University of California, Santa Barbara, USA

Professor Richard Hough, ARUP Australia, Sydney, Australia

Professor Santiago Huerta, Department of Construction, Technical University of Madrid, Spain

J Derrick Kendrick, School of Architecture, University of Adelaide, Australia

Professor Ken-Ichi Kimura, International Research Institute on Human Environment, Tokyo, Japan

Professor Ross King, Faculty of Architecture, Building and Planning, University of Melbourne, Australia

Dr Richard Kittler, Institute of Construction and Architecture, Slovak Academy of Science, Slovakia

Dr J C Lam, Department of Building and Construction, City University of Hong Kong, China

Professor Roderick J Lawrence, Faculty of Social and Economic Sciences, University of Geneva, Switzerland

Professor Li Bin, College of Architecture and Urban Planning, Tongji University, China

Professor William J Mitchell, Center for Media Arts and Sciences, MIT, USA

Professor Jack L Nasar, Department of City and Regional Planning, Ohio State University, USA

Professor Douglas Noble, Leavitt Graduate Building Science Program, University of Southern California, USA

Professor Bülent Özgüc, Faculty of Art, Design and Architecture, Bilkent University, Turkey

Professor Jens Pohl, Collaborative Agent Design Research Center, California Polytechnic State University, USA

Professor Wolfgang F E Preiser, School of Architecture and Interior Design, University of Cincinnati, USA

Professor Anthony D Radford, School of Architecture, University of Adelaide, Australia

Professor Helen Ross, School of Natural and Rural Systems Management, University of Queensland, Australia

Professor Stephen Sharples, Environmental Design and Sustainability, University of Sheffield, England

Professor Edna Shaviv, Climate and Energy Laboratory, Technion Israel Institute of Technology, Israel

Professor Koen Steemers, Martin Centre for Urban Studies, University of Cambridge, England

Professor Emeritus Peter R Tregenza, Department of Architecture, University of Sheffield, England

Professor Brenda Vale, School of Architecture, University of Auckland, New Zealand

Professor Jacqueline Vischer, Faculty of Environmental Design, University of Montreal, Canada

Associate Professor Terence Williamson, School Architecture, University of Adelaide, Australia

Dr Stephen K Wittkopf, School of Design and Environment, National University of Singapore, Singapore

Dr Xu Leiqing, College of Architecture and Planning, Tongji University, China

Dr Mohammad Ali Yaghan, College of Architecture, University of Petra, Jordan

Professor Zeng Saixing, Antai School of Management, Shanghai Jiao Tong University, China

Editorial and Publishing Office: Faculty of Architecture, Design and Planning, The University of Sydney, Sydney, NSW 2006, Australia. **Telephone:** (612) 9351 2801; **Fax:** (61 2) 9351 3031. Please send all editorial correspondence to the Editor-in-Chief at asreditor@arch.usyd.edu.au, and all subscription correspondence to the Accounts Officer at asrsubs@arch.usyd.edu.au.

Web: www.arch.usyd.edu.au/asr.

Manuscript Submission Guidelines

Authors and readers of the *Architectural Science Review* will appreciate that uniformity of presentation and adherence to international editing conventions are essential in any journal. Submissions are to be prepared per the below instructions. We ask contributors to follow these instructions carefully and to spend a few minutes reviewing recent papers in Volume 49(3), September 2006 forward, all of which are in the newly revised *ASR* style.

Preparation of Manuscripts: The *Architectural Science Review* adopts the Harvard/Royal Society/APA publication style. For assistance, consult APA 5th in EndNote, <http://www.apastyle.org> or <http://owl.english.purdue.edu/workshops/hypertext/apa/index.html>. Manuscripts should be prepared in MS Word in A4 size using 12 pt double-spaced (without extra spacing before or after lines) with 2.5 cm margins [1 in] all round.

Layout and Style: Headings should not exceed two levels – Main Headings and Secondary Headings – both Caps and lower case, with the title and main headings in **Bold Face** and secondary headings in ***Bold Italics***. Do not number headings. *ASR* uses the metric International System of Units (SI) (conversions to Imperial units may be given in parentheses). Footnotes and endnotes are to be avoided. Abbreviations and acronyms should be explained in full when first used (with the abbreviation or acronym in parentheses). If there are many abbreviations, give a list as a boxed table. Symbols should be explained when first used, and if there are many, should be listed and defined in a boxed table. Quotations of more than 40 words should be set off clearly by indenting the left-hand margin. Use double quotation marks for direct quotations and single quotation marks for quotations within quotations and for words or phrases used in a special sense. Spelling is to be in accordance with the Oxford English, Macquarie or Webster's American dictionaries. All references should be accessible to readers, ie, published by internationally recognised publishers or in internationally recognised refereed journals that can be found easily.

Formulae, Tables and Figures: Create formulae using Word's Equation Editor, MathsType or Expressionist. Use Word's Table for formatting tables. Rules and borders on tables should be 0.5 pt. Figures should be prepared in greyscale (no colour) using Adobe Illustrator, Microsoft® Office, EPS, JPEG, TIFF or Adobe Photoshop. Line drawings should be prepared as vector graphics using Adobe Illustrator or Illustrator EPS. Lines generally should be 0.5 pt and not less than 0.25 pt, and in-fill patterns and screens should have a density of at least 10%. If bitmapped graphics are necessary, TIFF is the preferred format. Submit line drawings at 600-1200 dpi and line drawings with some grey at 600 dpi. Submit photographs in 300 dpi. For screen dumps, leave as is. Higher resolutions will not improve output quality, but will increase file size, which may cause printing problems. Provide tables and figures that will approximately fit the standard typeset areas of the journal. Ensure that text in tables or on figures is of an appropriate font size for legibility. Avoid font-related problems by using standard fonts such as Times New Roman or Ariel. Number tables and figures separately, with a caption above tables and underneath figures, adequate to inform the reader. Indicate the preferred location for each table and figure by <Insert Table x or Figure y about here> at the preferred location between paragraphs in the text.

References: Authors submitting papers should reference the relevant international scientific and technical literature, including papers published previously in *ASR*; an annual index is included with each December issue, and search using the Abstracting & Indexing Services listed at the front of this journal. All references are to be in the Harvard/Royal Society/APA in-text format (eg, Gunaratnam, Hayman, Julian & Smith, 2007). In the list of references, titles of books, journals and published conference proceedings are to be in *Capital Italics*, not underlined. Include the City: Publisher for all non-journal references. If a reference is not in English, translate the title into English (in parentheses). Do not reference unpublished or internal reports, unpublished papers, conference papers that have not been published, or papers or books in languages that are unlikely to be known to a majority of readers. Cite the date of retrieval for any on-line refereed publications and major government reports, but do not cite ephemeral or non-peer-reviewed website information.

Organisation and Length of Manuscripts: As *ASR* is a double-blind refereed journal, organise the manuscript in the following order: Cover page with Title, authors (no titles) and affiliations for all authors, and international telephone and facsimile numbers and e-mail address for the corresponding author. If authors have different affiliations, identify them by superscripts (* ** *** etc), with the corresponding author identified by a dagger (†). Include on the cover page a recommended Running Head, a 100-150 word Abstract that summarises the intent, methods, finding and conclusions of the paper, and up to six alphabetized Keywords. The text of the manuscript should begin on the next page with no authors' names, affiliations or self-identifying citations in the remainder of the manuscript, followed by Acknowledgements, References, Tables and Figures. Number the pages consecutively on the bottom right, but do not insert headers or footers. There is no absolute page or word length, but to increase the flow of papers through the journal without compromising scientific quality and presentation, most manuscripts are 4000-6000 words and 8-10 published pages. Shorter Research Notes of 2000-3000 words are also welcome. Brevity is preferred, with fewer words if there are more tables or figures.

English Language Editing: Authors for whom English is not the first language are strongly encouraged to have their manuscript carefully edited prior to submission. International Science Editing and Asia Science Editing provide English language services for those who need assistance before submission or during revision for publication. Authors can contact these services directly at <http://www.internationalscienceediting.com> and <http://www.asiascienceediting.com>. Please note that *ASR* neither endorses nor takes responsibility for any products, goods or services offered by outside vendors.

Additional Materials: Computer printouts, tables of raw data, appendices and colour illustrations will not be published, but an indication may be given in the article where auxiliary data may be obtained.

Original Material: Submission of a manuscript implies that the work described has not been published previously (except in the form of an abstract or as part of an academic thesis), that it is not under consideration for publication elsewhere, that its submission is approved by all authors, and that, if accepted, it will not be published elsewhere in the same form in English or in any other language without the written consent of the Publisher.

Manuscript Submission: Submit manuscripts in A4 format electronically to asreditor@arch.usyd.edu.au with “*ASR*Submission” in the subject line. Submit tables and figures each on a separate page at the end of the manuscript but in the same Word file. Submit all figures per the above instructions in greyscale (no colour; please print ahead of time to check on clarity and resolution before submission). Submit also a PDF file containing only the tables and figures.

Editorial Rights: The Editor reserves the right to return manuscripts that do not conform to these Guidelines or do not fit the scope of the journal, and to make final copy-editing changes in accordance with international editing conventions.

ARCHITECTURAL SCIENCE REVIEW

Volume 50, Number 3, September 2007

Contents

- Vale Professor Henry Jacob Cowan** 195
Gary T. Moore
- Structural Developments in Tall Buildings: Current Trends and Future Prospects** 205
Mir M. Ali and Kyoung Sun Moon
- Applying Natural Ventilation for Thermal Comfort in Residential Buildings in Singapore** 224
Wang Liping and Wong Nyuk Hien
- Identifying Streetscape Features Significant to Well-Being** 234
Arnold R. Spokane, Joanna L. Lombard, Frank Martinez, Craig A. Mason, Deborah Gorman-Smith,
Elizabeth Plater-Zyberk, Scott C. Brown, Tatiana Perrino and José Szapocznik
- Southern Drift: The Learning Styles of First- and Third-Year Students of the Built Environment** 246
Richard Tucker
- Tile Renovation of Exterior Walls for the Taiwan Governor's Office** 256
Jih-Shong Wu and Ren-Jye Dzung
- Removing Unwanted Heat in Lightweight Buildings Using Phase Change Materials in Building Components: Simulation Modelling for PCM Plasterboard** 265
Christopher Kendrick and Nicholas Walliman
- A Case Study Survey of Harmonic Currents Generated from a Computer Centre in an Office Building** 274
Ming-Yin Chan, Ken KF Lee and Michael WK Fung
- Space Planning and Energy Efficiency in Laboratory Buildings: The Role of Spatial Activity and Temporal Diversity** 281
Filbert Musau and Koen Steemers
- Book Reviews** 293
H.J.Cowan (Book Review Editor)

Publication Information

Annual Subscription Rates: The *Architectural Science Review* (ISSN 0003-8628) is published quarterly.

2008 Rates	Australia (inc. GST), NZ & PNG	Elsewhere (incl Airmail postage)
Libraries/Institutions	\$AUD 195.00	\$AUD 375.00
Individuals	\$AUD 85.00	\$AUD 115.00

Payment is in Australian dollars by cheque made out to The University of Sydney or by credit card (MasterCard or Visa). Rates include airmail postage, insurance and annual combined list of contents and index. Agents are entitled to a 20% discount. Cancellations are accepted but no refunds given. There are no claim limitations and most back issues are available.

Advertising Information: Advertising orders and additional information on subscriptions are available from the Accounts Officer at the above publication address or via asrsubs@arch.usyd.edu.au.

Abstracting & Indexing Services: The *Architectural Science Review* is abstracted and indexed in the following: Aluminum Industry Abstracts, Architectural Publications Index (API) and Architectural Database (RIBA), Australian Architecture Database (ARCH), Australian Public Affairs Information Service (PAIS), Avery Index to Architectural Periodicals, Cambridge Scientific Abstracts (CSA), Ceramic Abstracts/World Ceramics Abstracts, Chartered Institute of Building Construction Information Quarterly, Civil Engineering Abstracts, Compendex (CPX), Corrosion Abstracts, DIALOG, Earthquake Engineering Abstracts, Ei Monthly, Ekistic Index of Periodicals, Electronics and Communications Abstracts Journal, Elsevier Engineering Information, Engineering Index, Engineering Information (Ei), Engineered Materials Abstracts, Environmental Sciences and Pollution Management, Ergonomics Abstracts, Gale Publications, IBSEDEX International Building Services Abstracts, ICONDA, International Civil Engineering Abstracts, Journal of Planning Literature, Mechanical & Transportation Engineering Abstracts, METADEX, ProQuest, Scopus and University Microfilms/UMI. This list is currently under review, with other major abstracting and indexing services to be added.

Copyright: © 2007, *The University of Sydney*. All rights reserved. The *Architectural Science Review* and all contributions contained in it are protected under international copyright by The University of Sydney. No part of this publication may be reproduced in any material form (including photocopying or storing in any medium by electronic means and whether or not transiently or incidentally to some other use of this publication) without the written permission of the publisher, except for the following terms and conditions:

Photocopying: A single photocopy of a single article may be made for personal or research use as allowed by national copyright laws, but must be accompanied by the copyright notice and exact reference to the article, journal, date, volume number and inclusive pages. Permission of the Publisher and payment of a fee is required for all other photocopying including multiple or systematic copying, copying for advertising or promotional purposes, resale and all forms of document delivery. Special rates are available for educational institutions that wish to make photocopies for non-profit educational classroom use. Permission may be sought from the Publications Officer at asrpubs@arch.usyd.edu.au.

Derivative Works: Subscribers may reproduce tables of contents or prepare lists of articles including abstracts for internal circulation within their institutions. Permission of the Publisher is required for resale or distribution outside the institution, and for all other derivative works, including compilations and translations.

Electronic Storage or Usage: Permission of the Publisher is required to store or use electronically any material contained in this journal, including any article or part of any article greater than 500 words in total from one issue. Except as outlined above, no part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without prior written permission of the Publisher. Address all permission requests to the Publications Officer at asrpubs@arch.usyd.edu.au.

Author Benefits: There are no page charges for publication in this journal. The Corresponding Author will receive sufficient complimentary copies of the issue in which the contribution is published to distribute to each co-author.

Notice: No responsibility is assumed by the Editor-in-Chief, the Editorial Advisory Board or the Publisher for any injury and/or damage to persons or property as a matter of product liability, negligence or otherwise, or from any use or operation of any method, products, instructions or ideas contained in the material herein. Although all advertising material is expected to conform to ethical standards, inclusion in this publication does not constitute a guarantee or endorsement of the quality or value of such product or of the claims made of it by its producer. The data and opinions appearing in the articles and advertisements herein are the sole responsibility of the author, other contributor or advertiser concerned. Accordingly, the Publisher, the Editorial Advisory Board and the Editor-in-Chief and their respective employees, officers, and agents accept no responsibility or liability whatsoever for the consequences of any such inaccurate or misleading data, opinion, or statement.

ISSN: 0003-8628

Printing: In Australia by the University of Sydney Printing Service