

**PUBLICATIONS
AND
THESES**

1987



**NATIONAL
UNIVERSITY OF SINGAPORE**

THE NATIONAL UNIVERSITY OF SINGAPORE

**PUBLICATIONS
AND THESES**

(abstracts)

1987

PREFACE

Publications and Theses is now in its 21st year of publication. This edition consists of abstracts of publications and theses which appeared in print between 1 January 1987 and 31 December 1987 (unless otherwise stated), the authors or joint authors of which were at the time, staff members or postgraduate students of this University.

It is hoped that this book will keep members of this University informed of research done in areas outside their own fields and therefore encourage multi-disciplinary approach to the solution of problems and research. An annual like this will also make others aware of the expertise available in this University thereby providing opportunities for the promotion of ties and collaboration.

Enquiries on research collaboration may be addressed to: The Director, University Liaison Office, 3rd Floor, Administration Building, National University of Singapore, 10 Kent Ridge Crescent, Singapore 0511.

Other enquiries regarding the publication itself can be directed to: Miss Irene Koh, at tel: 7722315.

SAMPLE ENTRIES

The following are some sample entries to help readers use the publication more effectively:

A: BOOK

Author	Title of book	
/	/	
Saw, S H.	<i>New population and labour force projections and policy implications for Singapore.</i>	99 pp. Singapore: Institute of Southeast Asian Studies.
	/	/
	No of pages	Place of publication
		/
		Publisher

B: PART OF BOOK

Authors	Title of article	Source	
/	/	/	
Chan, K B and L Lam.	Community, kinship and family in the Chinese Vietnamese community: Some enduring values and patterns of interaction.	In <i>Uprooting, Loss and Adaptation: The Resettlement of Indochinese Refugees in Canada</i> , eds. K B Chan and D Indra, pp. 15-26.	Canada: Canadian Public Health Association.
/	/	/	
Editors	Page nos. of contribution in book	Place of publication	Publisher

C: CONTRIBUTION IN JOURNAL

Author
Chow, Y K.
Title of paper
 Three-dimensional analysis of pile groups.
 Source
Journal of Geotechnical Engineering, ASCE, ed. T B Edil, 113(6): 637-651.
 USA: American Society of Civil Engineers.
 Publisher
Editor
Vol. no.
Series No.
Page nos.

D: CONFERENCE PAPER

Author
Lun, K C.
Title of paper
 Mobilising resources for child survival and development: Information resources. In *Proceedings of The Symposium on Child Survival, Population and Development for Parliamentarians from ASEAN Countries*, 9-11 June 1987, Jakarta, Indonesia, pp. 66-68.
 Source
 Jakarta, Indonesia: UNICEF.
 Publisher
Page nos.

E: REVIEW

Author
Woon, W.
Author/Editor of article under review
 Review of R J Walker, *The English Legal System*. In
 Article reviewed
Malaya Law Review 29(1): 355-356.
 Source
Vol. no.
Series No.
Page nos.

F: OCCASIONAL PAPER

Authors
Tan, K P and T S Tan.
Title of paper
Switchbox routing using score function.
 Publisher
 Singapore: Department of Information Systems and Computer Science, National University of Singapore, Occasional Paper No. TR 41/87.
 Paper no.

G: THESIS

Name of postgraduate student
Cheng, S M.
Title of thesis
 Industrial democracy in a corporatist state: A study of Singapore. PhD thesis, University of Queensland.
 Degree awarded
University from which degree is obtained.

When an entry has two or more staff members' names, the entry appears under the name of the first author. The names of the joint authors are then cross-referenced.

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FACULTY OF ARCHITECTURE AND BUILDING

SCHOOL OF ARCHITECTURE

Abdul H M Hussain. High-rise public housing in Singapore. In *Proceedings of the XIV IAHS World Congress on Housing*, 13-17 October 1987, Berlin, West Germany.

The paper analyses overall planning and architectural aspects of public housing in relation to the political objectives of providing housing for the nation.

It also highlights the aspect of climate and lifestyle and shows how orientation, configuration and colour has been optimised to achieve the benefits of the tropical climate.

Chang, T J. See p. 6.

Chng, B G and R Powell, eds. *Singapore Institute of Architects Journal*. Nos. 140-145 (six volumes). Singapore: Singapore Institute of Architects.

Gan, C E. See Department of Philosophy, p. 66.

Harrison, J D. Environmental trails for school children. *Singapore Institute of Architects Journal* 140: 7-10. Singapore: Singapore Institute of Architects.

This article, which was commissioned for the special edition on education, explains the value of environmental trails as educational tools, from Primary to University level as a means of making young citizens more aware of their home environment. Different kinds of trails, with specific objectives, can serve different functions and their value may be both in the activity of their compilation and also in their value as a resource and guide. Examples and advice on how to choose a suitable trail, and cautions to prospective trail blazers are given. The article is illustrated by the author.

Harrison, J D. Protection by design (or when is a wall not a wall?). In *Proceedings of the Inter-faculty Conference on the Protection of Buildings from the External Environment*, 12 February 1987, Singapore, pp. 7/1-7/5. Singapore: National University of Singapore. Also published in *Singapore Institute of Architects Journal* 141: 40-42. Singapore: Singapore Institute of Architects.

Hillier's Four Function Model defines one aspect of the building as an environmental filter and from this standpoint designers can arrive at solutions by comparing the existing external climate with the desired internal conditions to arrive at an elegant design solution in which the building envelope modifies the climate. The overall form of the building can be shaped to optimise environmental control; orientation and sunscreening can be explored using the appropriate design 'tools' and hostile external conditions can be tamed by architects without needless energy use.

- Heng, C K.** The making of a French new town, Cergy Pontoise. *Singapore Institute of Architects Journal* 145: 53-55. Singapore: Singapore Institute of Architects.

This article describes the regional development plan for the Parisian Basin and its new towns. It examines the role that a statutory board, EPA Cergy Pontoise, plays in the creation of the new town, Cergy Pontoise, and the architectural and urban diversity possible under a system adopted by the EPA.

- Hyde, R A.** Architectural identity in school building. *Singapore Institute of Architects* 190: 3-6. Singapore: Singapore Institute of Architects.

The paper discusses the issue of how a sense of identity can be created in school buildings. Three case studies are discussed and the qualities that create identity analysed and explained.

- Hyde, R A and J Gilleard.** An evaluation of the use of micro-computer for teaching perspective to architectural students. *Singapore Institute of Architects* 144: 44-49. Singapore: Singapore Institute of Architects.

The paper explores the use of the scribe 3-D modelling system to help architectural students generate perspectives of their designs. An evaluation of the results of a number of tests carried out with a sample of first-year students is discussed.

- Hyde, R A.** See also Department of Japanese Studies, p. 62.

- Lam, K P and R A Hyde.** Wrestling with the productivity curve — CAD in architectural education. *Singapore Institute of Architects Journal* 144: 41-43. Singapore: Singapore Institute of Architects. Also published in the *Proceedings of the AUSGRAPH 87 International Conference*, 4-8 May 1987, Perth, Western Australian.

With the rapid pace of development in computer technology, we are no longer concerned so much with the viability of performing certain tasks as with how efficiently and effectively the task can be accomplished.

The paper addresses this issue of productivity with respect to the use of computers in architectural education. Various CAD teaching methodologies are summarised and a case study which describes the process-oriented approach is presented.

- Lim, J S H.** Obituary — Claude Anthony Eber. *Singapore Institute of Architects Journal* 145: 61. Singapore: Singapore Institute of Architects.

C A Eber (1907 — 1987) was a senior architect of the PWD during 1958–68. He designed many significant public buildings during the period and helped developed the PWD style of architecture. His early training between 1926 till 1947 is reviewed with connections to Westerhoute and Oman, the municipal and the public works.

Lim, J S H. The new home for SIA and building centre. *Singapore Institute of Architects Journal* 145: 26–27. Singapore: Singapore Institute of Architects.

The new premises for the Singapore Institute of Architects at Orchard Road was originally designed by D S Petrovitch, ARIBA, as the 'Malayan Motors Showroom' in 1925.

The article describes the architectural style in the context of industrial architecture from Europe and Singapore.

Lim, J S H William Swaffield — The colonial furniture designer of Singapore and Malaya. *Heritage*, ed. C L Lee, 9: 61–71. Singapore: National Museum, Singapore.

This is a profile of W Swaffield who designed furniture for the Crown, the British PWD in Singapore and Malaya and thence in Australia between the 1920s and 1970s. His design work for the Supreme Court, Singapore and Kuala Lumpur, and the Istana Iskandariah (Perak) and Balai Besar (N Sembilan) are reviewed in detail.

Lip, E. Planning building with reference to *feng shui*. *Architecture Australia Journal of Royal Australian Institute of Architects*, March 1987, pp. 40–42.

This paper introduces the art of placement (the placement of buildings and furniture, natural and man-made elements) to the readers. It gives a brief introduction on the historical background of the art and refers to Chinese town planning, the natural phenomena and how they are related to the art of placement. It also mentions experiments made by researchers on the in-built sensors of living things. The paper also states the changing cycles of *feng shui* in relation to the positioning of stars and planets and the element and symbolism of the constellations. Finally, the paper describes the houses in China and how they are planned in relation to *feng shui*.

Lip, E. Chinese temple architecture. *The Architects Journal of the Royal Institute of British Architects*, March 1987, pp. 27–29.

The paper defines the functions of Chinese temples and describes the architecture, religious implication, and aesthetic impact of these buildings. The effects of ornamentation, lighting and other decorated elements are described complete with architectural elements such as the *dou-gong* (brackets) and eaves finishes. The paper also presents the historical aspects and describes how the immigrants in the 19th century brought their culture, religion and building technique to Singapore. Chinese architecture as far back as the Han Dynasty and

the application of the ancient art of *feng shui* and planning are also mentioned. The technical aspects of design with reference to orientation, daylighting, site planning are discussed complete with colour rendering and roof ornamentation.

A magnificent temple in Singapore, Tian Fu Gong, is described complete with its historical background.

Lip, E. *Feng shui* and buildings. *Singapore Institute of Architects Journal*, June 1987, pp. 60–64.

This paper defines what is *feng shui* and the earth's energy, *qi*. It mentions how China's cities were geomantically planned. The planning of the Forbidden City is described. How architects experience the practice of geomancy is described and how the design and planning of a building is affected by *feng shui* is given. Numerous illustration of siting, symbolic implications of buildings in relation to *feng shui* are given e.g. Frank Lloyd Wright's Talissin West, Chinese pavilions, Notre Dame Cathedral etc. Finally, how shapes, geometry, symbolism and patterns are related to *feng shui* is discussed in the last section. The paper contains 13 of the author's free hand drawings.

Lip, E. Chinese furniture. *Traveller* June 1987, pp. 34–36.

This paper describes Chinese furniture and the various types of furniture. A brief historical introduction is followed by examples. It is illustrated with colour slides of furniture.

Ong, B L. CAAD as a creating tool. In *Proceedings of CEPA 1987 Spring Conference*, 22–23 June 1987, Washington, USA, ed. W F Till, pp. 20–29. USA: CEPA.

CAAD has been developed largely from the viewpoint of automated drafting. The School of Architecture has, however, used proprietary CAAD software to teach basic graphic design skills. The paper describes the teaching methods used and speculates upon possible future directions in the development of CAAD as a design tool.

Powell, R. Conservation of meaning. In *Proceedings of the United Nations Centre for Regional Development, International Seminar on Innovative Strategies for Metropolitan Development and Conservation*, 14–17 November 1987, Kyoto, Japan, pp. 21/1–21/20. Japan: United Nations Centre for Regional Development.

The underlying principles of conservation are examined taking the standpoint that conservation of meaning is fundamental. Conservation should be directed towards the indigenous society and the continuing momentum of the culture.

From this theoretical standpoint the paper looks at a case study of conservation in Singapore, a country which has undergone rapid development in the last two decades. The question of whether conservation can be justified on the basis of tourism is also addressed.

Powell, R. Geoffrey Bawa: Seminal works in tropical architecture. *Singapore Institute of Architects Journal* 143: 54–57. Singapore: Singapore Institute of Architects.

This paper examines the work of Geoffrey Bawa, an architect who successfully fuses the past and the present and transforms the emotions, the atmosphere and the layers of Sri Lankan history into modern architecture. His building forms are distilled from an understanding of climate, geography and the waves of civilisation that have swept over Sri Lanka from Mesopotamia, Nepal, India, the Hellenistic Empire, Rome, the Aryan Sinhalese and the South Indian Tamils together with successive European influences. He produces buildings of a timeless quality which give a clear indication of the direction of architecture in South Asia.

Powell, R. Conservation in Asia. *Architecture Journal*, eds. C N Lo and T K Sabapathy, pp. 41–54. Singapore: School of Architecture, National University of Singapore.

This paper looks at the underlying principles of conservation specifically in Asia taking the standpoint that meaning is fundamental. Conservation should be directed towards the indigenous society and the continuing momentum of the culture.

From this theoretical standpoint the paper looks at a case study of conservation in Singapore, which has undergone rapid development in the last two decades. The question of whether conservation can be justified on the basis of tourism is also addressed.

Powell, R. Ideal house \times 10,000 \neq Ideal community. *Singapore Institute of Architects Journal* 145: 49–52. Singapore: Singapore Institute of Architects.

Public housing is always a sensitive issue, the numbers involved are usually high and the built results, despite the earnest endeavours of architects to create a more humane and livable environment, have been poor in most cases. It is not, according to Charles Correa, a matter of design talent; it is rather an inevitable outcome of our methodology which ever since Corbusier has sought to design the ideal house and clone it. This paper summarises a workshop which sought to develop a methodology whereby the large numbers were disaggregated in an effort to put back into housing variety, identity, participation and pluralism, qualities which the modern movement conspicuously left out.

Powell, R, ed. *School of Architecture Bulletin*. 1A + 15 pp. Singapore: School of Architecture, National University of Singapore.

Powell, R. Review of K Yeang, *Tropical Urban Regionalism*. In *Singapore Institute of Architects Journal* 144: 51.

Powell, R and C T Wong. The contemporary kampong. In *Proceedings of the XV IAHS Congress on Housing*, 9–11

December 1987, Singapore. Singapore: International Association of Housing Science.

If one looks into Malaysian society for a social unit which approximates to the modern planners concept of an urban 'neighbourhood' one would start with the model of a rural kampong. It consists of a number of families who have grouped together on grounds of commonality. They share common values and common practices. This paper examines how the cultural aspects, forms and social organisation of the traditional village could be used to improve the design and layout of low-income urban housing.

Powell, R. See also p. 1.

Rao, S P and T J Chang. *Thermal improvements of industrial roofs in Singapore.* 159 pp. Singapore: School of Architecture, National University of Singapore.

Light weight roofs are commonly used in single storey factories since they are less costly. Also, they can span across larger areas. This report, submitted to the Ministry of Trade and Industry, Government of Singapore, summarises the results of field surveys from JTC factories. Results of experimental studies on six model huts are reported. Findings and recommendations are presented.

Smith, R A. The role of development and conservation in tourism in Singapore. In *Proceedings of the United Nations Centre for Regional Development, International Seminar on Innovative Strategies for Metropolitan Development and Conservation*, 14-17 November 1987, Kyoto, Japan, pp. 22/1-22/29. Japan: United Nations Centre for Regional Development.

Comprehensive conservation is relatively new to Singapore. The city-state has been preoccupied with modernisation and industrialisation and had assigned conservation a low priority. Government attention has now been focused on conservation, primarily because of a sharp decline in the country's tourism industry. There has been a reordering of development policies. Master plans for conservation have been prepared. Some of these have already been initiated. This paper examines the role of tourism as a generator of conservation policies in Singapore. Some effects of this form of development as opposed to other forms are identified and the future prospects for conservation in Singapore are discussed.

Smith, R A. The development of natural landscaped sites for recreational purposes in Singapore. In *IFLA Yearbook 1986/87*, ed. A S Schmid, pp. 93-97. Versailles, France: International Federation of Landscape Architects.

This paper focuses on the island resort of Sentosa which is popular with both Singaporeans and tourists. Sentosa is 334 hectares in area and issues of importance in developing such a large site for recreational purposes are identified. These include the integration of existing natural landscape with intensely used

recreational activities, the dispersal of recreational attractions in a large site to maximise landscape potential which gives rise to related transportation problems, the use of landscape to modify the hot-humid tropical climate to allow mid-day activities, the conflict of imposing new recreational uses on previous, in this case military, uses, and the merging of reclaimed land with the existing landscape.

Smith, R A. Recreation for high-rise living in Singapore. *Habitat International*, eds. O Koenigsberger, S Groak and B Bernstein, 11(3): 123–139. Great Britain: Pergamon Journals.

The developments of the last two decades have brought a complete change to the residential patterns of Singapore. The over-crowded, unhygienic cubicles in terrace houses have given way to well-planned, public high-rise high-density housing blocks in which over four-fifths of the entire population now live. Many also live in high-rise private housing. Such a dramatic physical change has had equally significant social and other impacts. This is particularly evidenced in the area of recreation where attitudes to leisure pursuits are undergoing a continuing transformation. Evolving modern values coupled with national economic prosperity and security have raised expectations in terms of leisure. However, the physical limitations of a small city-state and widespread high-rise living in a tropical climate, have imposed restrictions on solutions to recreational needs.

This paper examines the present pattern of recreation as related to high-rise living in Singapore where innovation in the provision of recreational facilities is highlighted.

Wong, C T. Computers and the creation of a new metalanguage in architecture. *Singapore Institute of Architects* 143: 42–43. Singapore: Singapore Institute of Architects.

Architecture and its aesthetics have set ordered patterns. This lends itself to be easily recognised, simulated and deconstructed by computers. Through such analysis, essences could be discerned. Archives of typologies could be generated for compositional purposes.

Wong, C T. See also p. 5.

Woods, P C. Specification of lighting quality. In *Proceedings of Illuminating Engineering Society (Australia) National Convention*, 17 November 1987, Australia, Section 12, pp. 1–10. Australia: IES.

The paper considers the ways in which architects convey to lighting engineering notions of quality in the design of lighting installations. The traditional aspects of quality in lighting design are viewed from the standpoint of the architect and his general perception of quality in design. The area of communication of design intentions for quality in lighting by the architect is reviewed and limitations in current practice explored. Alternative techniques for visual representation of lighting appearance will be presented in the session with particular reference to the resources required to produce such specifications and the role of the lighting engineer in interpreting them into luminaire selection and layouts.

Woods, P C. Lighting energy usage and lighting levels in commercial buildings. In *Proceedings of 4th ASEAN Energy Conference*, 5 November 1987, Singapore, pp. 503-516. Singapore: ASEAN Working Group on Non-conventional Energy Research.

This paper considers the development of lighting design standards and accepted criteria for good lighting design. The control of lighting load density in commercial buildings in Singapore is traced through the development of regulatory standards. The impact of this regulatory approach is explored through the results of a survey of commercial buildings which post date the regulations.

Woods, P C and J F Pickup. Potential improvements in lighting energy usage in commercial buildings. In *Proceedings of 4th ASEAN Energy Conference*, 5 November 1987, Singapore, pp. 517-530. Singapore: ASEAN Working Group on Non-conventional Energy Research.

This paper reviews the potential energy usage improvement by adopting one or more of several lighting design strategies. The effectiveness and likely user reaction to such measures are discussed. The mechanisms for introducing these strategies are also considered.

Woods, P C. See also School of Building and Estate Management, pp. 18 and 23.

SCHOOL OF BUILDING AND ESTATE MANAGEMENT

Briffett, C. The investigation of building defects. *UNIBEAM*, ed. M Lim, XV: 37-38. Singapore: Building and Estate Management Society.

Undertaking the task of investigating building defects is far from a simple process and requires considerable skill and expertise. This article presents the procedures to be followed in determining causes of defects and highlights the importance of being methodical, comprehensive and observant.

Briffett, C. Lessons from the past and pointers for the future. In *Proceedings of the Inter-faculty Conference on Property Management and Public Policy*, 9 January 1987, Singapore, pp. C/1-C/8. Singapore: National University of Singapore.

This paper addresses the main themes of the conference and presents a summing up of the day's proceedings. The main message identifies a world of 'change' for which property managers are advised to be more flexible, innovative and professional and advocates the need for constant updating of public policies.

Briffett, C. External finishes case studies on problems and solutions. *SIAJ* 144: 35-40. Singapore: Singapore Institute of Architects.

The performance of external enclosures as weatherproofers to Singapore buildings is particularly poor. Problems of extensive leakage, loosened and cracked claddings, stained and worn facades and deteriorating structures abound. Adverse effects on the structure and finishes, the furniture and fittings and the inhabitants is common place. There are lessons to be learned from the good, warnings to be heeded from the bad and painful reminders to be witnessed from the ugly.

This paper identifies the major problems through a case study analysis as a means of design feedback.

Briffett, C. Design feedback successes and failures. In *Building Maintenance Economics and Management*, ed. A Spedding, pp. 215-222. UK: E & F N Spon.

Design feedback is a familiar technique to members of the building team but is it appropriate, worthwhile or necessary? Designers and maintainers involved in the collection and use of feedback must weigh the cost against the benefits. Developers and owners can adversely affect the time required to implement it. Property managers and building users often determine the standard of quality achieved by it.

The need for and nature of design feedback is questioned by these conflicting objectives.

This paper assesses the validity of design feedback, investigates the areas of research and methods of education concerned with it and discusses the practical applications.

Briffett, C. Growth potential for maintenance and retrofitting. *Times Directory of Construction Services* pp. XI-XII. Singapore: Times Publications.

The maintenance and retrofitting sector of the construction industry has perhaps never attained such importance as in Singapore today. The total building stock erected over the last 30 years, amounting to some \$120 billion, now represents a massive investment which deserves considerable attention and demands efficient and sophisticated forms of management. As a result, the value of implementing maintenance and retrofitting schemes is now being recognised and the prospects for this sector as a major growth industry is very high indeed.

This review highlights the potential for growth in the maintenance and retrofitting sector of the construction industry in Singapore.

Briffett, C. Flat roof problems in Singapore. *SIAJ* 139: 11-14. Singapore: Singapore Institute of Architects.

Flat roofs provide problems worldwide for maintenance managers but failures may often occur from localised causes particularly climatic effects. This article uses locally derived case studies in Singapore to explain the common faults, how they have occurred and how they should be amended.

Briffett, C. Structural failures — Survey techniques and report procedures. In *Proceedings of the International Conference on Structural Failures*, 30–31 March 1987, Singapore, Vol. 2, Section L, pp. L/1–L/24. Singapore: Singapore Concrete Institute.

Many professionals are requested to prepare written reports deriving from inspections made of building defects during their career. Experience has shown that few achieve this task successfully. This has nothing to do with technical expertise, the analysing of problems, use of testing methods or a knowledge of remedial works. It is simply an inability to communicate effectively in the written form.

Competency in survey inspections is frequently measured by the standard of report writing and it is imperative that every professional develops a technique that produces clear, concise and accurate reports both for the client's satisfaction and for the protection of his own reputation.

This paper discusses methods of report writing and relates them to suitable survey techniques in the structural surveying of buildings.

Briffett, C. Professionalism in property maintenance. *The Singapore Professionals* 11(2): 8–10. Singapore: The Professional Centre.

Property maintenance is one of the most underrated, neglected and misunderstood aspects of property management. In consequence it suffers from a poor image, is given low priority, and attracts few skilled or qualified personnel. Above all it lacks an effective disciplined area of management expertise. The results of inattention, ignorance and incompetence are plain to see in the deteriorating condition of buildings and the proliferation of building defects.

This review identifies the nature of professionalism and suggests how it could be achieved in property maintenance.

Briffett, C. See also p. 11.

Chanda, M and S K Roy. *Plastics Technology Handbook*. 553 pp. USA: Marcel Dekker Inc.

In this book is provided useful background data on the processes, materials and techniques adopted by the plastics processing industries in a form suitable for students as well as practising engineers. It can be used as a text for undergraduate and graduate level courses in plastics and polymers. The book contains four chapters. In the chapter on characteristics of polymers are described the definition of polymer, molecular weight, polymerisation processes, configurations, conformations, crystallinity, structural shape, thermal transitions, designing a polymer structure for improved properties, cross linking, solubility behaviour, effects of corrosives, thermal stability and flame retardation, deterioration, stabilisation, diffusion and permeability, compounding, and toxicity. The second chapter entitled fabrication processes discusses types of processes, compression molding, transfer molding, injection molding, extrusion, blow molding, calendering, spinning of fibres, thermoforming, casting reinforcing and foaming processes. The chapter on plastics properties and testing deals with

mechanical, electrical, thermal and optical properties as well as reinforced plastics and testing of plastics. The final chapter on industrial polymers gives a description of addition, condensation and special polymers.

Chua, B G and C Briffett. Waterproofing basements. *The Professional Builder* 3(1): 33-42. Singapore: Singapore Institute of Building.

Many of Singapore's new multi-storey commercial developments have built-in basements usually designed to provide necessary car parking facilities. Building underground obviously poses major problems in construction techniques because of the need to be structurally capable of withstanding earth pressures as well as providing the necessary support to the super-structure. In many local sites the ground water table is high and every basement needs a waterproofing system that will prevent or collect and discharge incoming water.

This paper describes the methods used in waterproofing basements and evaluates their viability.

Dutt, A J. An investigation of natural ventilation in a community hall building. *International Journal of Housing Science, USA*, ed. O Ural, 11(2): 95-106. USA: International Association for Housing Science.

The paper deals with the investigation of the wind generated natural ventilation of a two-storey university students' community hall situated in the West district of the Republic of Singapore. A 1/100 scale model of the full size building was tested in the 2m x 1m working section of the School of Building and Estate Management. Boundary layer wind tunnel for various wind directions. The velocity coefficient method of estimating natural ventilation was used. It was found that for each wind direction certain parts of the building were better ventilated than the others and size and location of door and window openings contributed considerably to the ventilation. Generally, the natural ventilation system of the building was good with its present orientation.

Dutt, A J. Protection from wind and rain penetration in buildings. In *Proceedings of the Inter-faculty Conference in Protection of Building from External Environment*, February 1987, Singapore, ed. N Robinson, pp. 91-97. Singapore: National University of Singapore.

In the design of buildings, protection from wind and rain penetration presents a major environmental factor. The paper deals with the wind-flow patterns around high-rise, medium-rise and low-rise building and their influence on the rainwater penetration in the buildings. Shape of buildings, setting and terrain category on which the buildings are situated influences wind movement and rain penetration considerably. Methods are suggested to protect the buildings from wind and rain penetration.

Dutt, A J. Wind action on steel chimney. In *Proceedings of the Third International Conference on Steel Structures*, March 1987,