
**PUBLICATIONS
AND THESES**

1990



**NATIONAL UNIVERSITY
OF SINGAPORE**

Preface

This twenty-fourth edition of *Publications and Theses* consists of abstracts of theses and other publications of National University of Singapore staff and postgraduate students for the calendar year of 1990.

The publication aims to keep members of the University informed of research done in areas outside their own fields in order to help encourage a multi-disciplinary approach to research and the solution of problems. As an annual, it is a useful compendium of the expertise available in this University, providing opportunities for the promotion of more academic link-ups and research collaboration.

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

Other enquiries regarding the publication itself can be directed to Mrs Ellice Lim, at tel: 7722316.

Sample Entries

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

BOOK

Authors
Stewart, DW and PN Shamdasani.
Title of book
Focus Groups: Theory and practice. 153 pp. Newbury Park, California:
 Sage Publications, Inc.
Publisher *No. of pages* *Place of publication*

ARTICLE IN BOOK

Authors
Tan, TS and CH Tan.
Title of article
 Role of transnational corporations in transfer of technology to Singapore. In
Technology Transfer in The Developing Countries, ed. M Chatterji, pp. 335-
 344. London: The Macmillan Press Ltd.
Place of publication *Publisher* *Source* *Page nos. of contribution in book*

CONTRIBUTION IN JOURNAL

Author
Low, SP.
Title of paper
 The organisation of construction export marketing: Theory and practice.
Journal of Real Estate and Construction, I (1): 82-98.
Source *Vol. No.* *Series/Issue no.* *Page nos.*

CONFERENCE PAPER

Author
Dutt, A.J.
Title of paper
 Steel for high-rise building. In *Proceedings of the Fourth International Conference on Steel Structures and Space Frames*, 15-16 February 1990, ed. TJ Macginley, pp. 69-72. Singapore: American Institute of Steel Construction and Structural Society.
Full title of published proceedings
Editor
Page nos.
Country of publication
Publisher
Date of conference

EDITING WORK FOR BOOK

Editor
Quah, SR. (Ed.)
Title of book
The Family as an Asset. An International Perspective on Marriage, Parenthood and Social Policy. 388 pp. Singapore: Times Academic Press.
Place of publication
Publisher

OCCASIONAL PAPER

Author
Yeo, GK.
Title of paper
 A framework for developing simulation game systems. Singapore: Department of Information Systems and Computer Science, National University of Singapore, Occasional Paper No. TRA 4/90.
Paper no.
Publisher

REVIEW

Author
Tan, KYL.
Article reviewed
 Review of *Sanctions and Rewards in the Legal System: A Multi-disciplinary Approach*, by ML Friedland, *Malaya Law Review*, 32(1): 201-203.
Editor/Author of article under review *Source* *Vol. no.* *Series/Issue no.* *Page nos.*

THESIS

Name of postgraduate student
Yeoh, KW.
Title of thesis
 Synthesis and polymerization of surface-active and polymerizable sodium acrylamido alkanoates. PhD thesis, National University of Singapore.
University from which degree is awarded

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Faculty of Architecture and Building

school of architecture

Foo, AF.

The work of the School of Architecture, NUS with particular reference to final-year thesis projects. *Journal of the Singapore Institute of Architects*, May/June 1990: 20-29.

This paper was first delivered during a seminar at the Technical University of Berlin, West Germany. The variety and diversity of Year 5 thesis projects dealing with topical issues within the local and regional context demonstrates the tone and direction of the School's philosophy. It is recognized that no architecture is inherently appropriate unless it is defined by the context. Thus, as the only School of Architecture in Singapore, strategically located in the heart of Asia, the philosophy of the School embraces two foundational components in its education thrust, i.e. addressing the needs and priorities of the country and the concept of regionalism in the tropical environment.

Foo, AF.

German architecture and architectural education after WWII as represented by West Berlin. *Architecture Journal* 1990, pp. 32-39.

West Germany suffered severe destruction during WWII. Within a relatively short span of 40 years, the reconstruction achievements have been impressive, reflecting a great sense of purpose, incisiveness and industry of the people. The International Architectural Exhibition held periodically in Berlin at 20-year intervals is particularly significant and exemplary. It demonstrates a continuous and relentless effort of learning from and improving on what has been built. The flexibility and diversity of the architectural course which lasts four years presents an opportunity for career exploration and self-discovery. Although each state university with its own constitution enjoys a good measure of autonomy, the central control is evident within the framework of the federal *General Framework for Higher Education* in view of the phenomenal growth of the number of new universities since 1960.

Harrison, JD.

Maintenance as an aspect of architectural design. In *Proceedings of the International Symposium on Property Maintenance, Management and Modernisation*, 7-9 March 1990,

Singapore, ed. LK Quah, pp. 1086-1096. Singapore: Longmans.

The inevitability of maintenance obliges the architect to make adequate provision to reduce or facilitate this by good design, specification or detailing, and to convince the client of the benefits related to the building's lifespan. Awareness of maintainability should allow consideration of appropriate forms of access, including various permanent systems. Operational safety, and reduction of secondary damage during maintenance are discussed. The designer's creativity may actually be helped in thus shaping the building; cases of buildings exemplifying this are cited. Rethinking of some common maintenance problems may provide clues to better design, and the paper summarizes the relevant factors which should be a natural part of any design process.

Liggett, RS¹, WJ Mitchell² and M Tan.

Multi-level analysis and optimization of designs. In *Evaluating and Predicting Design Programme*, ed. YE Kalay. New York: John Wiley.

This article discusses a knowledge-based computer-aided design system that provides multi-level analysis capabilities, and that automatically propagates constraints on design variables from level to level. It also supports the formulation and solution of optimization problems at different levels, so that a solution can be approached by solving a sequence of appropriately constrained sub-

optimization problems. Theory and implementation are discussed, and a detailed case study of application to the design of small house plans is provided.

Lim, JEM.

Against technological applique. *Institute of Architects Journal*, Sept/Oct 1990(162): 35-42.

When technology is pursued for its own ends in architecture, costly and complicated constructions with little utilitarian advantage may result. It is promising that in recent years, the engineers have gone beyond the provision of a technical response by trying to understand the architectural objectives and taking an active part in developing the concept of the building. Problems arise when the technological responses are a result of objectives which are themselves questionable.

Lim, JEM.

Architecture and engineering. *Architecture Journal* 1990, pp. 57-62.

The evolution of the present roles of the engineer and architect have arisen from their historical origins and their influence on their professional and social status, as well as the influence of their training on separate design values and aims. Their separate attitudes are a consequence of the industrial need for specialized knowledge and skill to widen the scope of possibilities in production and building. The specialization in design of related entities prevents effective integration between

¹ RS Liggett — Graduate School of Architecture and Urban Planning, University of California, Los Angeles, USA.
² WJ Mitchell — Graduate School of Design, Harvard University, USA.

members of the design team. This is caused by gaps in understanding often neglected in many forms of academic training which emphasize professional competence. The gaps in understanding would persist if no attempts are made to "bridge" them at the level of principles and ideas.

Lip, E.

Management skill, the oriental approach (management of building estates). In *Proceedings of Conference*, April 1990, pp. 66-73. Glasgow: University of Strathclyde.

This paper gives an insight into management skills; the oriental approach. It then discusses the important aspects concerning the management of buildings and real estate.

Mitchell, WJ, RS Liggett and M Tan.

Top-down knowledge-based design. In *The Electronic Design Studio*, eds. M McCullough, W Mitchell and P Purcell, pp. 137-148. Cambridge, MA: MIT Press.

This paper describes a prototype knowledge-based computer-aided design programme which supports stepwise refinement of a schematic idea into a complete and detailed design. The system is designed to provide a library of schemata for various types of artifacts, together with rules for edit refinement of schemata through shape substitution. Parametric variation can also be carried out on each schema; the repercussions of which are propagated down to the

next schematic level. The programme is thus an implementation of "parametric shape grammar". The paper discusses the programme at three levels: (1) at a user's level as an interactive graphics system for drawing and design; (2) at a programmer's level as an environment for encoding knowledge of how to draw or design things; and (3) at the substructure level as a software which maintains a data structure and provides a graphics interface.

Powell, R. (Ed.)

The Architecture of Housing. 301 pp. Geneva: The Aga Khan Award for Architecture.

Powell, R.

Hyper-reality and architecture. *Singapore Institute of Architects Journal*, 163: 38-39.

There is a certain irony in the demise of the indigenous *kampung* village in Singapore and simultaneously the construction of the Malay Village in Geylang Serai. As we bid farewell with varying degrees of nostalgia to the absolutely real we embrace with varying degrees of affection or bemusement the absolutely fake. However, for future generations, it is the latter that will shape ideas about the nation's past. The absolutely unreal will become reality.

Powell, R.

The Architectural Exhibition. *Singapore Institute of Architects Journal*, 160: 32-34.

This is a critique of the Thesis Year Exhibition in the School of Architecture focusing on current attitudes and directions in architectural education in Singapore.

Powell, R.

Boccarà's Morocco. *Interiors Quarterly*, Sept 1990: 34-38.

Modern regional architecture has been said to "take the abstract qualities of a region's built heritage; the massing, solids and voids, proportions and sense of space, use of light and structural principles and transform them into architecture that is relevant to the present". There is a symbiosis between universal values and regional culture. Charles Boccarà's approach to design is relevant to architects in other cultures seeking to create modern architecture which embodies cultural continuity.

Powell, R.

Behind Bawa's Walls. *Interiors Quarterly*, Dec 1990: 35-37.

Authentic hybrid modern architecture is illusive but at its best it penetrates to the generating principles and symbolic sub-structures of the past, then transforms these into the forms that are right for the present. Geoffrey Bawa's work in Sri Lanka is seminal and has a timeless character which fuses universal and local values, modern technology and vernacular tradition.

Powell, R.

Architectural criticism. *Singapore In-*

stitute of Architects Journal, 162: 21-22.

Insight into the critical process is vital to the quality of architectural education and practice. Criticism is a powerful and necessary tool to the advancement of the individual and to professional performance, thus to better environments. Its role is to inform the future through discerning interpretation of past and present situations.

Powell, R.

See page 6.

Rao, SP.

Development of a new insulated cladding system. *Construction Industry Development Board Annual Report*, eds. D Teng and WA Teng, pp. 53-56. Singapore: Construction Industry Development Board, Singapore.

Results of tests conducted in Singapore on a new type of insulated cladding utilizing the concept of radiant barrier are described. Tests were conducted over a three-week period in July-August 1988 at the Faculty of Architecture and Building, National University of Singapore. The results conclusively prove the effectiveness of the radiant heat barrier in a warm-humid climate, in reducing the heat ingress and thus leading to better, thermally comfortable, conditions indoors.

Rao, SP.

Effect of intermittent rainfall on net

heat transfer across a brick wall. *Energy and Environment into the 1990s*, 4: 2728-2732.

Singapore is situated near the equator and experiences a hot-humid climate. This paper reviews briefly the Singapore climate. The salient features of a unique revolving type room calorimeter designed and developed by the author are discussed. The facility has been fully instrumented and nearly 100 points are logged continuously. Experimental results on half-brick thick walls subjected to intermittent simulated rainfall are discussed.

Rao, SP.

Performance of some transparent water proofing chemicals under the Singapore climate. *Building Maintenance and Modernisation Worldwide*, ed. LK Quah, 2: 738-749. Singapore: Longmans.

The rain-water penetration and surface condensation on interior walls or roof surfaces in new buildings is not peculiar to Singapore alone. It is almost a universal problem faced by several countries. However, over the last few years there has been an increase in complaints of this nature in Singapore. This paper reviews the aggressive climate of Singapore and its effects on the performance of some building materials. Special emphasis has been given for the causes of rain-water penetration in the local buildings. Some of the rain-resistance standards for walls as well as the water-proofing problems are considered.

Tan, M.

Closing in on an open problem — Implementing a strategy to encode emergent sub-shapes. In *Proceedings of the Association of Computer-aided Design in Architecture (ACADIA) 10th Annual Conference*, 4-6 October 1990, Big Sky, Montana, USA.

The interpretation of drawings, by breaking them into sub-shapes and classifying these sub-shapes, is an essential part of creative designing. Drawings must be open to different interpretations (i.e. different decompositions into parts, and classification of these parts in different ways) but conventional CAD systems do not readily allow this. Their data structures are too inflexible, and they do not provide sub-shape or implied-shape recognition capabilities. This paper proposes a theoretical foundation for the development of CAD systems in which drawings are open to reinterpretation, and demonstrates the application of this theory with a prototype computer programme.

Tan, M.

Saying what it is by what it is like — Describing shapes using line relationships. In *The Electronic Design Studio*, eds. M McCullough, W Mitchell and P Purcell, pp. 201-213. Cambridge, MA: MIT Press.

Designs evolve. The forms in design are therefore seldom static; instead, they are perpetually open to transformations. And since transformations involve relationships, conventional methods of describing shapes as sets

of discrete endpoints may not provide an appropriate foundation for schematic design. This paper presents an alternative relational description of shapes based on the concept of construction lines. This is demonstrated in a prototype computer programme which supports the recognition of emergent sub-shapes. It shows that a data structure designed around shape relations is better suited to cope with reduction rules for the crucial intersection and colinear conditions.

Tan, M.

See pages 2 and 3.

Tay, KS³, R Powell and BH Chua.⁴

Kampung Bugis Development Guide Plan. 28 pp. Singapore: Singapore Institute of Architects.

The *Kampung Bugis Development Guide Plan* (DGP) intends to create the urban structure within which many different developers and their design consultants can fashion a rich and vibrant place to live and work. The DGP seeks to capture the essence of living in the equatorial region: it

encourages landscaping, outdoor activities and the positive use of sun and rainfall within the "Poetics of Tropicality". The *Kampung Bugis DGP* interprets a vision of a Tropical City into practical reality.

Wong, CT.

Obiangism and ornamentation: Architecture in need of theory. *Singapore Institute of Architects Journal*, 160: 38-39.

This paper adds another layer of texts on to the then existing debate on "obiang" or "bad taste" ornamentation that has crept into current architecture. On this issue, the paper engages with Tay Kheng Soon's sociological analysis and Cyril Seah's formal relativism; how both criticisms stem from their own privileged positions. In such an engagement, the paper tries to reclaim lost ground by discussing ornamentation within the current social cultural period that we live in. And in so doing, show how ornamentation can never be totalized into an ahistorical category; something which is on Kheng Soon's agenda.

³ Tay, KS — Architect in private practice.

⁴ BH Chua — Department of Sociology, NUS.

school of building and estate management

**Aldred, JM¹, ML Wong², SM Ng³
and SK Roy.**

Waterproofing concrete roofs in tropical climates. In *Proceedings of the 15th Conference on Our World in Concrete and Structures*, 23-24 August, 1990, Singapore, pp. 35-42. Singapore: CI-Premier Pte Ltd.

The paper describes the work done at the National University of Singapore on different waterproofing systems for roofs, including waterproofing by use of watertight concrete.

Aldred, JM, SK Roy and SM Ng.

Watertight concrete for a wet tropical environment. In *Proceedings of the Fourth Symposium on Our Environment*, 21-23 May 1990, National University of Singapore.

The paper presents preliminary work by the National University of Singapore on different approaches for improving the intrinsic watertightness and durability of concrete.

**Ang, AL⁴, M Taib⁵, C Briffett,
K Mathur, KB Poh⁶.**

Expert systems in building diagnostics — Application in flat roof problems. In *Proceedings of Building Services Seminar on Improving Building Performance*, 14 December 1990, Singapore, pp. 3-1 to 3-15. Singapore: School of Building and Estate Management, National University of Singapore.

The development of expert systems has undergone considerable advances in recent years with the marketing of more sophisticated shells and the increased contributions of experts prepared to deploy their skills and experience for the benefit of both the uninitiated and professional users. Building diagnostic systems are now available for investigating and solving dampness problems, waterproofing enclosure walls, and concrete and timber defects. This paper outlines the techniques employed to develop an expert system to diagnose flat roof problems in Singapore.

Betts, M.

Methods and data used by large building contractors in preparing tenders. *Construction Management and Economics*, 8(4): 399-414.

The process of submitting lump-sum competitive tenders continues to be commonly practised by UK building contractors. Any means of improving the efficiency of this process would be very welcome to contractors and to the construction industry as a whole. This paper documents methods of tender preparation in the form of a model of the tasks executed. The model has been produced with the aim of documenting items of data that are used. This has been done using techniques of structured systems analysis including data flow diagrams and a data dictionary. Resulting from this analysis is

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2 ML Wong } Graduates, School of Building and Estate Management, NUS.

3 SM Ng }

4 Ang, AL } Research Assistants, School of Building and Estate Management, NUS.

5 M Taib }

6 KB Poh — Public Works Department, Singapore.

a definition of data potentially used by building contractors in tendering. This definition gives a better opportunity for the more purposeful and complete application of information systems to the tendering process as a means of improving its efficiency. The paper therefore provides a specification of data to be used in the development of information management systems to support building contractors' tendering.

Betts, M.

The costs of tendering: Is it worth it? *Research and Development Report*, Rider Hunt Levett and Bailey, Report Number 2.

This paper comments on the way in which tendering is conducted in the private and public sectors of the Singapore construction industry. It includes a critical appraisal of how effective such procedures are for individual contractors, for the quantity surveying profession and for clients and the industry as a whole. The paper then concludes by arguing the case for changing the way in which tendering is carried out locally with the aims of reducing the costs to the industry, speeding up the process of procurement and creating an environment in which better quality construction can take place.

Betts, M.

An appraisal of the Urban Redevelopment Authority tendering system for land parcel sales based on the construction experience. In *Proceedings of the 12th Annual Building and*

Estate Management Society Seminar, 31 July 1990, Singapore.

Within the area of construction contracts, the practice of using open competitive tenders has been criticised. Alternative arrangements are explored in the construction industries of different countries for more efficient ways of selecting an organisation to carry out work and for a price for the work to be agreed upon. The URA sale of sites programme has been under way since June 1967 and has been fundamental to the achievement of the modern urban city. There have been modifications to the programme during its evolution and the procedure of its application continues to be re-examined. This paper aims to contribute to this re-examination by applying the principles that have derived from the building profession to the development sphere.

Betts, M.

See pages 7-10, 18 and 27.

Betts, M and RW Pollock.⁷

Expert systems for the interpretation of building contracts: what form should systems take and how could they be used? In *Proceedings of the International Council for Building Research Studies and Documentation (CIB W55/W65) Joint Symposium on Building Economics and Construction Management*, 14-21 March 1990, Sydney, Australia, 2: 405-419. Sydney: University of Technology, Sydney.

Expert systems are being developed for

⁷ RW Pollock — Head, Department of Surveying, Robert Gordon's Institute of Technology, Aberdeen, UK.

many areas of construction management and economics. A number of applications have been made so far in the area of contractual administration and interpretation. This paper examines the further potential for systems in this area by defining the general qualities of a suitable domain and evaluating the nature of this area according to these criteria. In doing so the nature of the contractual interpretation problem is commented upon. The paper concludes by evaluating the contribution that might be made by expert systems and by discussing the purposes to which the eventual systems may be put.

Betts, M and WD McGeorge.⁸

A conceptual framework for life cycle cost appraisal. In *Proceedings of the International Council for Building Research Studies and Documentation (CIB W55/W65) Joint Symposium on Building Economics and Construction Management*, 14–21 March 1990, Sydney, Australia, 2: 46-57. Sydney: University of Technology, Sydney.

This paper examines the nature of life cycle cost (LCC) appraisal as a technique for the financial management of buildings. The paper carries out a re-evaluation of LCC by focusing on a conceptual model proposed by the Building Performance Research Unit of Strathclyde University in 1972. The original proposals of the Committee for Terotechnology are also considered. Based on this evaluation the paper proposes that LCC appraisal should be based on a philosophy of performance evaluation which is de-

pendent upon each individual building being uniquely assessed according to a prescribed systematic approach. The paper concludes by reiterating the view that there must be widespread acceptance of a common conceptual framework before LCC can become the norm rather than the exception in building performance appraisal.

Betts, M, K Mathur and G Ofori.

Information technology in construction: The role of the SISV. In *Proceedings of the Singapore Institute of Surveyors and Valuers Annual Conference*, January 1990, Singapore. Singapore: Singapore Institute of Surveyors and Valuers.

One of the most significant challenges and opportunities facing the construction industry of Singapore in the 1990s is the extent to which it can make use of information technology (IT). For IT to be most purposefully applied requires that a coherent national framework, which has wide support, is able to coordinate individual developments. This paper describes a suggested framework for Singapore, including a consideration of its basic concepts of knowledge-based systems and integrated communication at the project, enterprise and industry levels. The paper then describes the role that the SISV and other professional institutions can play in developing and implementing the framework. It also refers to the actions that may be necessary for individual members of the SISV in amending their work practices in response to such a framework.

8 WD McGeorge – Professor of Building, University of Newcastle, Australia.

Betts, M, NM Robinson and J Santhanam.

Contractual interpretation: A Singapore project in expert system application. In *Proceedings of the International Conference on Building for the 90's*, 25-27 October 1990, Auckland, New Zealand, pp. 103-114. New Zealand: New Zealand Institute of Building.

This paper describes current work in the application of expert systems to the interpretation of the provisions of building contracts. A rule-based representation has been followed, drawn from distinct acquisition fields: legal principles and interpretation rules from documented texts, precedents and statutes; contractual provisions from locally relevant standard forms, and the heuristics applied by expert contract interpreters. The prototype is being developed for a range of interpretation problems and the system will ultimately be evaluated for its suitability for a number of system users and uses.

Betts, M, NM Robinson and J Santhanam.

Expert systems for building contract interpretation. Singapore: School of Building and Estate Management Construction Law Research Unit, National University of Singapore, Research Working Paper No. 009/90.

The report describes an on-going research project being carried out by the authors through the Construction Law Research Unit of the School. The work, which commenced in August

1989, is concerned with the interpretation of standard forms of building contract in their common law and statutory contexts and with the aid of expert systems technology. It is an attempt to address, in particular, the problems being experienced by local practitioners in the construction industry with the current highly complex and legalistic contract forms. The pilot study is described according to its progress to date, and appendices illustrate the approach being adopted.

Briffett, C.

Planning building maintenance work. In *Proceedings of the Property Maintenance and Management Conference*, 6-7 January 1990, Kuala Lumpur, Malaysia, pp. B/1-B/20. Malaysia: WTW Property Services Sdn Bhd.

This paper provides an evaluation of planning techniques used in building maintenance work and an assessment of how these factors influence effective performance.

Briffett, C.

Making building condition surveys. In *Proceedings of the Property Maintenance and Management Conference*, 6-7 January 1990, Kuala Lumpur, Malaysia, pp. C/1-C/11. Malaysia: WTW Property Services Sdn Bhd.

This is an overview of practice procedures for conducting comprehensive building condition surveys with case study notes on problems and how to overcome them.