

PUBLICATIONS
AND
THESES

1988



NATIONAL
UNIVERSITY OF SINGAPORE

THE NATIONAL UNIVERSITY OF SINGAPORE

**PUBLICATIONS
AND THESES**

(abstracts)

1988

PREFACE

Publications and Theses is now in its 22nd year of publication. This edition consists of abstracts of publications and theses which appeared in print between 1 January 1988 and 31 December 1988 (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

Authors *Title of book*
Robinson, N M and A P Lavers. *Construction law in Singapore and Malaysia.* 393 pages. Singapore: Butterworth (Asia).
No of pages *Place of publication* *Publisher*

B: PART OF BOOK

Author *Title of article* *Source*
Foley, J A. *Studies in Singapore: looking back and looking forward.* In *New Englishes: The Case of Singapore*, ed. J A Foley, 1-26. Singapore: Singapore University Press.
Publisher *Editor* *Page nos. of contribution in book* *Place of publication*

C: CONTRIBUTION IN JOURNAL

Author *Title of paper* *Source*
Chow, Y K. Three-dimensional analysis of pile groups. *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 *Source* *Title of paper*
Balasubramaniam, P. Technology transfer for lasers in medicine and surgery. In *Proceedings of the 5th International Conference on Biomedical Engineering*, 8-10 December 1988, Singapore, 42-44. Singapore: National University of Singapore.
Publisher *Page nos.*

E: REVIEW

Author *Article reviewed*
Cotton, J. Review of *Embattled Korea. The rivalry for international support*, by Ralph N Clough. *The Journal of Communist Studies* 4(3): 194-5.
Author/Editor of article under review *Source* *Vol. no.* *Series no.* *Page nos.*

F: OCCASIONAL PAPER

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

G: THESIS

Name of postgraduate student *Title of thesis*
Lam, S S. Estimation risk and the price behaviour of initial public offerings of common stock. PhD dissertations, University of Washington.
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.

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FACULTY OF ARCHITECTURE AND BUILDING

SCHOOL OF ARCHITECTURE

Harrison, J.D. *Designing for the disabled in Singapore.* *Singapore Institute of Architects Journal* 146: 44-50. Singapore: Singapore Institute of Architects.

The paper examines the nature of physical disability and the needs of disabled people in coping with the built environment, particularly with problems of access. As attitudes to disability change, expectations of disabled citizens increase. In the local context, this change is becoming more apparent as the population ages. In order to make optimum provision, the real and unique needs of Singapore need to be studied and catered for effectively; the alternative is to take overseas standards and apply them piecemeal, whereas what is required is a comprehensive approach towards achieving a barrier-free environment.

Harrison, J.D. *Conservation and the architect.* *Singapore Institute of Architects Journal* 147: 48-49. Singapore: Singapore Institute of Architects Journal.

This short article comments on a talk on conservation given by Professor Raymond Lemaire of the University of Louvain-la-Neuve, Belgium on 3 February 1988, which outlined the values of conservation of areas rather than just individual buildings, and provided some examples of how such projects could be done effectively in both visual and economic terms.

Hyde, R.A. *The changing face of school buildings.* *Singapore Institute of Architects Journal* 147: 40-47. Singapore: Institute of Architects.

The paper examines changes in the way schools have been designed in recent years and issues such as user evaluation, participatory design, identity in schools and conceptual developments.

Hyde, R.A. and B.Teo. *Computer graphics as a visualisation tool in design.* In *Proceedings of International Conference on Computer Graphics*, 15-16 September 1988, Singapore, 303-314. Singapore: ICONCG Organising Committee, School of Electrical and Electronic Engineering, Nanyang Technological Institute.

While CAAD systems are normally used at the production end of the design process, there is great potential, particularly with the graphics facility offered by such systems, to use them at the formative stage in the design process. The paper discusses ways of integrating the graphics facility of CAAD in the design process, details current avenues of research in developing intelligent graphics to enhance this usage of CAAD and the development of educational software for beginning students.

Lam, K.P. *High-rise public housing development in Singapore.* In *The Monograph of the Council of Tall Buildings and Urban Habitat*, ed. L.S. Beedle, 443-463. New York, USA: Van Nostrand Reinhold Company.

The article presents an overview of public housing development in Singapore in the past 25 years, attributing its success to the holistic approach. Besides the mere

provision of acceptable living accommodation, the development programme has responded to the challenge of building a total environment suitable for community development and improvement in the quality of life. The environmental context in which new towns are developed and the means to achieve urban and architectural design qualities are discussed. Innovations in the delivery process of the construction industry to meet targeted demands for residential units are also highlighted.

Lam, K P. Review of *IL 31: Bambus-Bamboo*, Information of the Institute for Lightweight Structures (IL), University of Stuttgart, Germany 1985. *MIMAR-Architecture in Development*, 28 (June): 83-84. Singapore: Concept Media Pte. Ltd.

Lip, E and B Lim*. *Architectural detailing for the tropics*. 157 pages. Singapore: Singapore University Press.

This book, on architectural and building construction detailing in the tropics, has about 120 architectural details by local and Malaysian architects redrawn by Evelyn Lip. These details and examples obtained from major buildings in Singapore and Malaysia represents the various components used in contemporary buildings which are generally applicable in the hot humid regions.

Lip, E. *Things Chinese*. 166 pages. Singapore: Graham Brash (Pte) Ltd.

This book gives insights into the traditions and cultural heritage of the Chinese people. It deals with a wide range of 86 topics in four sections: 1) Chinese beliefs and customs; 2) Chinese secular practices and activities; 3) Chinese people and places; and 4) things Chinese. It explains the origins of customs and festivals, the significance of personalities, artefacts and Chinese architecture, palaces, furniture, temples and Chinese cities. It also covers secular practices such as calligraphy, marriage ceremonies and presents old historical texts and classics. The wide range of interesting information has been selected from many branches of knowledge in the Chinese world and illustrated with over 100 sketches and drawings by the author. It is hoped that this book will promote a chosen cultural relationship between Oriental and Western readers.

Powell, R, ed. *Criticism in Architecture*. 166 pages. Singapore: Concept Media, for the Aga Khan Award for Architecture.

This book records the deliberations of intellectuals, critics and practising architects, who met in Malta, to define a broad framework for architectural criticism in the developing world where the massive influence of western media sharply contrasts with their counterpart in the Third World. The resulting dialogue is intellectually stimulating, entertaining and more importantly, goes some way towards filling a vacuum in the critical discourse in architecture of Muslim and non-Muslim countries. This is the third in a series of books for the Aga Khan Award for Architecture. Key

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papers are by Ismail Serageldin of Egypt, Hasan-Uddin Khan of Pakistan and Dennis Sharp of the UK. Distinguished critics included Pierre Vago, Peter Davey and Mildred Schmertz.

Powell, R. Carlo Scarpa—architecture and poetry. *Singapore Institute of Architects Journal* 151 (Nov-Dec): 25–28. Singapore: Singapore Institute of Architects.

This article analyses the work of Carlo Scarpa which embodies both 'incredible antiquity and incredible modernity.' The dialectic between modern and traditional architecture is examined in his work at *Museo de Castelvecchio*, *Fondazione Querini Stampalia*, and *Tomb of Brion Vega* at Castel Franco in Italy.

Powell, R. Shin Takamatsu-architecture in the Kansai region. *Singapore Institute of Architects Journal* 150 (Sept-Oct): 28–31. Singapore: Singapore Institute of Architects.

Shin Takamatsu is one of the aspirants to the leadership of a post-war generation of Japanese architects. In common with other post-modernists, he is in the process of reassessing the direction of modernism and seeking a synthesis between universal values, reflected in the modern movement, and tradition. His work contains abstractions of cultural symbols and resonances of craftwork and the Samurai tradition. The manner in which he accepts the technological benefits of modern architecture, combining it with a uniquely Japanese regional expression, is instructive to architects in other nations in Asia which are in a period of rapid transition.

Powell, R. Review of *The Future of Urbanism*, by Lester R Brown and Jodi L Jacobson. *Singapore Institute of Architects Journal* 146 (Jan-Feb): 63–64.

Powell, R. Review of *Singapore — A Guide to Building, Streets and Places* by N Edwards and P Keys. In *MIMAR — Architecture in Development* 30: 76–77. Singapore.

Powell, R and C T Wong. The contemporary kampung. *Majallah Akitek* 1–4 (Nov): 22–29. Malaysia: Pertubuhan Akitek Malaysia.

If one looks into Malaysian society for a social unit which approximates the modern planners' concept of an urban 'neighbourhood', one would start with the model of a rural kampung. It consists of a number of families who have grouped together on grounds of commonality: 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.

SCHOOL OF BUILDING AND ESTATE MANAGEMENT

Briffett, C. Building condition surveys. In *Proceedings of Conference on Facing Building Problems*, (17–18 November 1988, Singapore), 87–92. Singapore: School of Building and Estate Management, National University of Singapore.

Building condition surveys are an essential and important means of determining the state of the structure, components and finishes of buildings. Using diagnostic procedures and testing techniques it is possible to determine the sources which cause many building defects. This paper provides useful guidelines for practitioners involved in building survey work.

Briffett, C. The prevention and cure of rising dampness in building. In *Proceedings of the Conference on Planning, Physics and Climate Technology for Healthier Buildings, Healthy Buildings 88*, 5–8 September 1988, Sweden, ed. Burgitta Berglund Thomas Lindell, 2(5–8): 281–291. Sweden: Swedish Council for Building Research.

Problems of rising dampness in buildings is a common phenomena throughout the world despite extensive research into construction techniques and remedial action. This paper examines the reasons and proposes new approaches in the design, construction, and maintenance processes to improve the standards and performance of remedial work.

Briffett, C. The art and science of building condition surveys. In *Proceedings of the Whole Life Property Asset Management — CIB International Seminar*, 7–9 September 1988, ed. Danny S S Then, 183–196. Scotland: International Council of Building Studies and Documentation.

The need for surveying the condition of buildings is well recognised in developed countries but the techniques and procedures employed are often inadequate, wasteful or uneconomical. This paper reviews the nature of the professional skills required, identifies the purposes and use of collected data, categorises the types of surveys and provides guidelines on professional practice.

Briffett, C. The human factor in the performance of buildings. In *Proceedings of Conference on the Performance Requirements in Buildings*, 27–28 May 1988, Luxembourg, Vol. 2. Luxembourg: CSTB Centre Scientifique et technique du bâtiment.

The decision-making processes and organisational arrangements for completing building work exercises a considerable influence on the quality of the final product. This paper highlights the human influences on performance and presents an 'ability' concept as a solution to the problems.

Chong, S M. Plumbing and drainage work illustrated. In *Proceedings of the Singapore Institute of Surveyors & Valuers — Seminar Series for Continuing Professional Development, Quantity Surveying Division*, 10–26 January 1988, Singapore, Sections 17 and 22. Singapore: Singapore Institute of Surveyors and Valuers.

This is an examination and illustration of the local building industry's cost accounting rules which are represented in tabulated phraseology rulings consistent with current formats adopted in UK standard methods.

Christudason, A. The killer litter law: bark or bite? *The Malayan Law Journal*, [1988] 2 MLJ: xxxiii–xxxv. Singapore: Malayan Law Journal Pte Ltd.

This article examines the new legislation that imposed more stringent penalties on residents of HDB flats for killer litter offences.

Christudason, A and N Khublall. Building control in England and Hongkong — Systems and legal implications. In *Proceedings of the Conference on Inspection Repair and Maintenance of Building*, 28–29 April 1988 Singapore, 1–21. Singapore: Institute for International Research.

This paper examines the nature and systems of building control in England and Hongkong, providing a background to the study of the system in Singapore. The components of building control are highlighted and discussed. Whatever the system of control in any country, these components (i.e. enabling legislation regulations, byelaws and enforcement) will apply as they together make up the whole machinery of control. Mention is made of the need for an effective system of appeals procedures to ensure that there are checks and balances in the building control system.

Christudason, A and N Khublall. Legal issues relating to property investment. In *Proceedings of Conference on Property Investment, Development and Construction*, 27 September 1988, Singapore. Singapore: Datasearch Resources.

This paper deals with the relevant statutory provisions and important leasehold terms that may affect, in particular, a commercial property one may wish to invest in.

Dutt, A J. Wind loading on a sawtooth multiple hyperbolic paraboloid shell roof building. *International Journal of Space Structures*, ed. Z S Makowski, 3(1): 43–50. London: MultiScience Publishing Co.

Investigation of wind loading on a 'sawtooth' array multiple hyperbolic paraboloid (HP) shell roof building was performed by model test in the wind tunnel. Wind pressure distribution on the roof diagonals and walls of the building were determined for various wind directions. Average suctions and highest points suctions on 'sawtooth' array and 'normal' array roof having the same plan dimensions were compared.

Dutt, A J. Wind-induced oscillation damping of supertall buildings and structures. In *Proceedings of the Conference on Wind Loading on Building and Structures*, 26 April 1988, Singapore, ed. A J Dutt, AJD1-10. Singapore: National University of Singapore and Applied Research Corporation.

With the development of innovative structural systems coupled with the shortage of space in the urban areas, buildings and structures are becoming taller, lighter and more slender. As a result, the effects of wind loading causing oscillation on supertall buildings have become increasingly important in recent years. The paper deals with the source of such oscillation and methods to dampen them.

Dutt, A J. Wind effects on building and structures. In *Proceedings of the Conference on Facing Building Problems*, 17-18 November 1988, Singapore, 32. Singapore: School of Building & Estate Management, National University of Singapore.

The paper deals with the effects of wind with regard to wind loading on buildings and structures and wind-generated natural ventilation in buildings. For proper design of buildings, wind tunnel tests are required in order to ascertain these effects. Recommendations are made on the basis of tests and analysis.

Dutt, A J, ed. *Proceedings of the Conference on Wind Loading on Buildings and Structures*. 256 pages. Singapore: National University of Singapore and Applied Research Corporation.

Associate Professor Lim Lan Yuan, Head of the School of Building & Estate Management, delivered the opening address of the conference. The keynote lecture on 'Wind Engineering, Applications to Buildings and Structures — An Overview' was presented by Professor J E Cermak, University Distinguished Professor of Fluid Mechanics and Wind Engineering of the Colorado State University, USA, while the keynote lecture on 'Wind Sensitive Structures' was delivered by Professor W H Melbourne, Chairman, Department of Mechanical Engineering, Monash University, Australia. The other speakers were Dr T K Snathanam and Mr T S Ang who dealt with 'Computer Simulation of Wind Loading' whilst Associate Professor A J Dutt presented a paper on 'Supertall Buildings Oscillation'. All the papers are published in the proceedings.

Dutt, A J and K S Mathur. Application of microcomputer in the determination of wind forces on a hyperbolic paraboloid shell roof structure by wind tunnel model investigation. In *Proceedings of the International Conference on Computer Applications in Concrete*, 28-29 March 1988, Singapore, ed. Y S Lau, M14-M24. Singapore: Singapore Concrete Institute.

The paper deals with the application of an IBM microcomputer in the determination of wind loading on a HP shell roof structure by model investigation in the wind tunnel.

The non-dimensional wind pressure coefficients on the surface of the model were determined by using a Setra Pressure transducer and a Scanivalve and finally recorded in the printed format by using the software for various wind directions. The output gave both mean-pressure as well as average-pressure and peak-pressure coefficients. By this method, much time-saving and automation were achieved as compared to time required in the use of multiple manometers.

Dutt, A J and T George. Wind forces on a concrete shell roof structure. In *Proceedings of the Conference on Our World in Concrete and Structures*, 25–26 August 1988, Singapore, ed. S Y Tan, 78. Singapore: Singapore Ready Mixed Concrete Association and American Concrete Institute.

Shell roofs are being used extensively as they can cover a large area of space with a minimum of support, especially the hyperbolic paraboloid (HP) shells. The paper presents the results of research by wind tunnel model investigation of an open-sided HP shell roof structure. The non-dimensional wind pressure coefficients on the surface of the model were determined by using a Setra pressure transducer and a Scanivalve. The pressure signals for various wind directions were recorded by using an IBM micro-computer and software.

Field, B G. Public space, private development and community welfare. *Land Development Studies*, ed. A R MacLeary, 5(2): 139–144. UK: E & F N Spon Ltd.

This is an abridged version of a paper first presented at an inter-faculty research seminar at the National University of Singapore on Public Space Design, Use and Management. The focus is on the public spaces associated with certain private developments, e.g. plazas, arcades, atria, etc. In many urban settings, these spaces have become important amenities in their own right, with indoor spaces, in particular, often providing extensive and climatically controlled recreational opportunities free from the uncertainties of the external environment. Given the 'public goods' characteristics of these spaces, it is suggested that they deserve more detailed scrutiny since the potential 'welfare' benefits from increased provision might be considerable. To this end, it is argued that the planning authorities have both the duty and the power to encourage private developers not only to provide more public spaces but also to improve their accessibility.

Field, B G. Land-use and transport planning (part V): evaluation, limitations and conclusions. *Singapore Transport*, ed. J H Jamil, 3(3): 22–24. Singapore: Chartered Institute of Transport (Singapore).

This is the fifth and final article in a series focusing on the procedures involved in a traditional land-use transport study. The paper outlines the fragility of many of the assumptions underlying the methods for forecasting and evaluation, and suggests that analysts should pursue the development of more behaviourally sound techniques. Discrete choice models, based on the economics of consumer behaviour and the psychology of choice, have an intellectual appeal which has spawned a number of

attractive theoretical constructs but, in practice, the creation of practical, workable models is proving more elusive. Nevertheless, it is suggested that planning procedures still need to move away from the rather mechanistic extrapolations, traditionally characteristic of the highway engineer, towards a more policy-responsive, behavioural methodology.

Field, B G. Integrated land-use and transportation planning: the example of Singapore's Mass Rapid Transit system. In *Developing World Transport*, ed. M Heraty, 149–153. UK: Grosvenor Press International.

This paper argues that the development of Singapore's mass rapid transit system should not be considered simply in terms of the extent to which it addresses problems of urban traffic congestion, but should also be seen as a key component in a physical planning regime designed to restructure the urban fabric and guide long-term development towards the achievement of specific planning goals. It shows how, in conception and design, the system anticipates many of the transport problems that are common in cities elsewhere in the developed and developing worlds, and accommodates these by channelling movement to a well-planned and more locationally efficient pattern of land-use.

Field, B G and G Ofori. Construction and economic development: a case study. *Third World Planning Review*, ed. G Dix, 10(1): 41–50. UK: Liverpool University Press.

This is a reprint, for a wider international readership, of a paper first published by the Singapore Institute of Building in *Construction Management and Systems in Singapore*. The paper highlights the importance of construction by focusing on the crucial role the industry has played and continues to play in the development process. Whereas development analysts and strategists have produced an extensive literature on the respective roles and change patterns of the agricultural and manufacturing sectors, few have recognised the utility of construction in promoting and achieving their development goals. And yet construction is a highly visible contributor to the growth process, with constructed facilities providing the physical foundation upon which development efforts to improve living standards are established.

Khublall, N. *Singapore property tax — law and valuation*. 301 pages. Singapore: Longman.

As the title suggests, this book deals with Singapore property tax in all aspects beginning with a historical and economic background to property taxation and ending with a chapter on important controversial issues which could be the subject of possible reforms in the foreseeable future. The book deals extensively with matters such as imposition of property tax, the concept of annual value, perhaps, principles of assessment and valuation, administration and appeals. Important statutory provisions and cases are discussed and, where appropriate, comparisons are made with the position in England and Hongkong.

Khublall, N. Short fall in floor areas — legal implications. In *Proceedings of the Conference on Legal Developments in the Property Market*, 28 January 1988, Singapore, 1–16. Singapore: Institute for International Research.

This paper looks at the question of 'shortfall' in floor area in strata title residential properties in Singapore. Examples of shortfall are examined under the Housing Developers Rules prior to the amendments made in 1985, and thereafter a comparison is made in the light of the 1985 Rules. The position of the parties have been extensively dealt with, and particular attention is given to misrepresentation and misdescription. The paper in general attempts to prove that, although the 1985 amendments were intended to benefit purchasers, they in fact have eroded their common law rights.

Khublall, N. Singapore property tax. In *Proceedings of the 9th International Symposium on the Property Tax*, 22–30 November 1988, Barcelona and Seville Spain. USA: Lincoln Institute of Land policy.

This paper summarises the Singapore property tax system and highlights certain important issues which have been the subject of litigation and dissent. Some emphasis is given to the principles of assessment and valuation methodology in use especially where there are differences in approach between Singapore's and other recognised systems. The conclusion attempts to give an overall assessment of the Singapore property tax system.

Khublall, N and A Christudason. Building control in Singapore. *UNI-BEAM Building and Estate Management Society* 16: 15. Singapore: National University of Singapore.

In the light of the dramatic and tragic collapse of the Hotel New World Building a few years ago, the Singapore building control system was brought under the microscope for the purpose of improving it. This paper, presented at a conference by the authors, comments on the building control system in Singapore by examining such areas as the system of control prior to the amendments proposed in the recent Building Control Bill, the changes recommended pursuant to the inquiry into the collapse of the hotel building, relevant provisions in the Bill, a brief comparison with building control systems in England and Hongkong and, how effectively the proposed measures could operate to ensure the structural safety of buildings.

Khublall, N and R Tan*. Singapore taxation relating to investment in real property. In *Proceedings of the Conference on Property Investment Development and Construction*, 27 September 1988, Singapore, 1–17. Singapore: Dominion Conferences & Publications Pte Ltd.

Taxation relating to investment in real property is the main focus of this paper.

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Whatever the reason for such an investment, the cost to the investor will be uppermost in his mind. In addition to the purchase price of a property, an investor has to incur other costs as well, such as stamp duty. In the course of his ownership of the property, he has to pay property tax and, if the property is tenanted, income tax may be raised on the net income from the property. In some cases, a development charge has to be paid and, finally, upon an individual's demise, estate duty may have to be paid. This paper deals with these aspects of taxation.

Koh, A, L C Lau and D C L Thang. Real estate investment trusts (REITs): their feasibility in Singapore. In *Proceedings of the Singapore Institute of Surveyors And Valuers' Annual Conference*, 5 November 1988, Singapore.

The paper is intended to bring to the awareness of the professional circle a real estate investment concept not presently practised in Singapore. It examines the practicality of the setting up of REITs as another form of investment vehicle for investors against the backdrop of the local legal and economic environment.

Lau, L C. The use of quantitative methods in real estate investment decision-making in Singapore. *Singapore Management Review* 10(1): 23-31. Singapore: Singapore Institute of Management.

Real estate investment is capital intensive, has a lagged production schedule and carries very high risks. The main motivation is profit maximisation. Real estate developers and investors are known to rely on a qualitative approach in decision-making. How true is this in Singapore? This article is a synthesis of a survey on the application of quantitative methods in real estate investment decision-making, as opposed to the prevalent qualitative approach used by decision-makers in the real estate sector in Singapore. A pertinent issue included for discussion is the impact of computerisation on real estate practice.

Leong, T W. Maintenance for the serviceability and durability of concrete structures. In *Proceedings of the Conference in Facing Building Problems*, November 1988, Singapore, 67-68. Singapore: School of Building & Estate Management, NUS.

The causes of deterioration in concrete and steel arising from exterior factors such as forces and environmental conditions as well as interior factors such as porosity and permeability are discussed. The effects of deterioration upon reinforced and prestressed concrete structures are then considered. Various repairing methods for the restorations of old structures deteriorated under normal uses are briefly described. The requirement for regular inspection and maintenance for upkeeping the strength, serviceability and durability of a concrete structure is emphasised. An effective method developed primarily on the principle of preventive maintenance is proposed for the construction of future concrete structures.