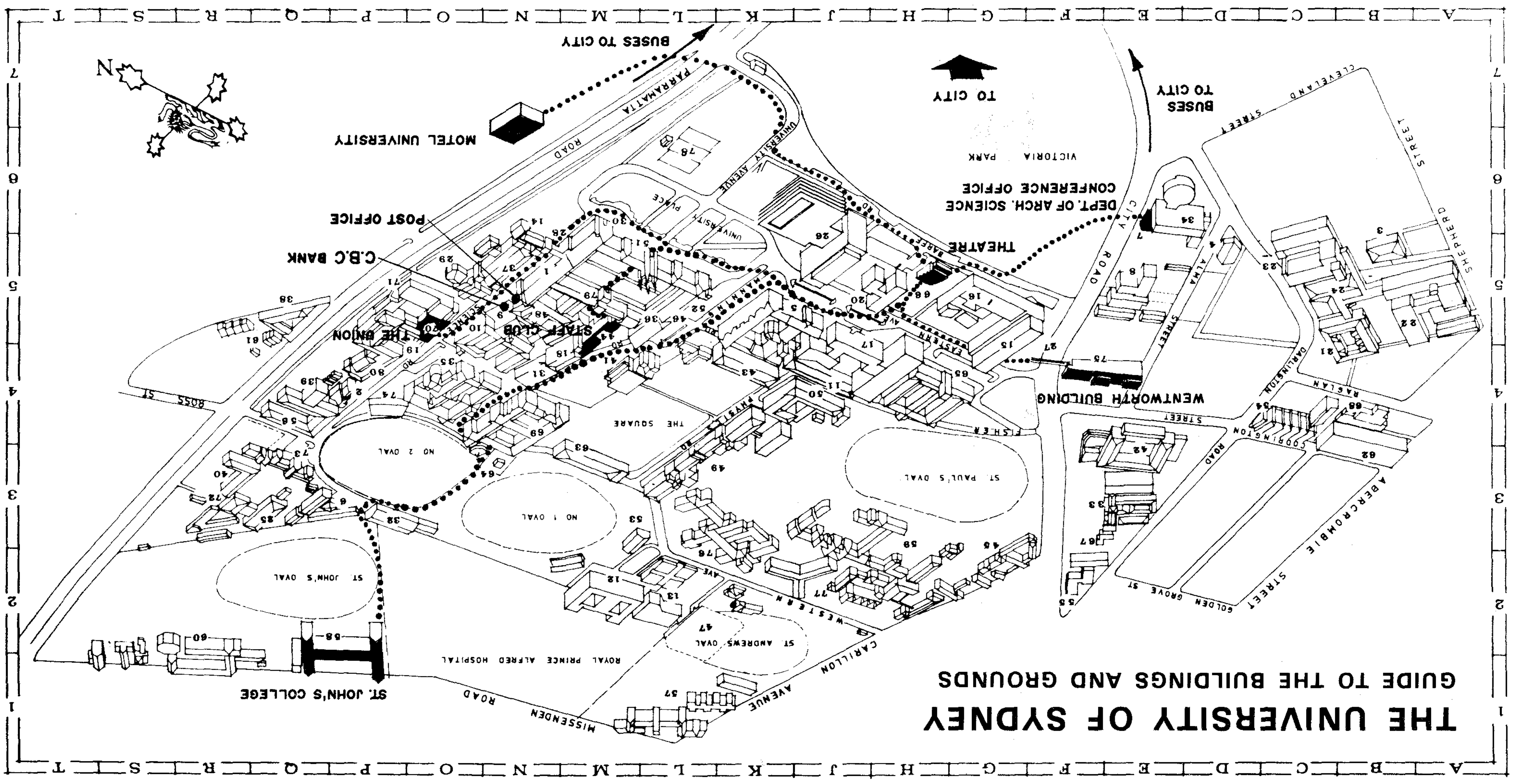
1. Administration Building ENQUIRY OFFICE	N5	41. Manning House, Women's Union	M4
2. Agriculture, R.D.Watt Bldg.	P4	42. Merewether Building	E3
3. Agriculture Rose St. Store	B5	43. Mills Building	K4
4. Agriculture Glass House	D5	44. Mungo MacCallum Bldg.	M5
5. Anderson Stuart Building	K5	45. Moore Theological College	G2
6. Animal Husbandry	P3	46. Nicholson Museum	L5
7. Architectural Science Bldg.	E6	47. Parking Structure Western Avenue	L2
8. Architecture Building	E5	48. Pharmacy Building	N5
9. Bank Building	N5	49. Physics School	L3
10. Badham Building	O5	50. Public Health and Tropical Medicine	J4
11. Biochemistry Building	J4	51. Quadrangle, East	L5
12. Blackburn Building	M2	52. Quadrangle, South	L5
13. Bosch Building	L2	53. Queen Elizabeth II Research Institute for Mothers and Infants	M3
14. Botany Building	N5	54. Recreation Centre	B4
15. Carslaw Building	G4	55. Regiment, University	F2
16. Carslaw Lecture Theatres	G5	56. Ross Street Building	Q4
17. Chemistry School	H4	57. St. Andrew's College	L1
18. Christopher Brennan Bldg.	N4	58. St. John's College	P2
19. Clubs & Societies Cottage	O4	59. St. Paul's College	H2
20. Edgeworth David Bldg.	H5	60. Sancta Sophia College	R1
21. Engineering Bldg., Chemical	B5	61. Selle House	Q5
22. Engineering Bldg., Civil	A5	62. Services Building	B3
23. Engineering Building, Electrical	C5	63. Sports Centre	M3
24. Engineering Building, P.N.R.	C5	64. Sports Union Building	N3
25. Evelyn Williams Bldg.	Q3	65. Standards Lab., CSIRO	H4
26. Fisher Library	J5	66. Stephen Roberts Theatre	H5
27. Footbridge, Keith Murray	F4	67. Sydney University Press	E3
28. Gallery of Fine Arts War Mem.	N5	68. Sydney University Union's Child Care Centre and the Shepherd Centre	B4
29. Geology Building (Old)	O5	69. Teachers' College	N4
30. Great Hall	M5	70. The Union	O5
31. Griffith Taylor Bldg.	N4	71. Union Theatre	P5
32. Gymnasium, H.K. Ward	P3	72. Veterinary Clinic	R3
33. Institute Building	E3	73. Veterinary Science, J.D. Stewart Building	Q3
34. International House	E6	74. Wallace Theatre	P4
35. John Woolley Building	O4	75. Wentworth Building	F4
36. MacLaurin Hall	L5	76. Wesley College	K3
37. Macleay Museum, Zoology	N5	77. Women's College	J2
38. Mackie Building	Q5	78. Women's Tennis Courts	L6
39. McMillan, J.R.A. Bldg.	Q4	79. Western Tower	M5
40. McMaster Lab., CSIRO	R3	80. Zoology Building	P4



AUSTRALIAN AND NEW ZEALAND CONFERENCE ON THE PLANNING AND DESIGN OF TALL BUILDINGS

AUSTRALIAN AND NEW ZEALAND CONFERENCE ON THE PLANNING AND DESIGN OF TALL BUILDINGS

Wednesday, 15 August 1973

LIMITATIONS ON THE DESIGN OF TALL BUILDINGS

9.00 am **The effect of wind and earthquakes on the design of tall buildings.**

Chairman
Mr N Sneath, Assistant Director-General (Structural), Commonwealth Department of Works, Melbourne.

Speakers
Assoc Prof B J Vickery, Department of Civil Engineering, University of Sydney.
Dr E Rosenblueth, Director Instituto de Ingenieria, National Autonomous University of Mexico.
Assoc Prof R Shepherd, Department of Civil Engineering, University of Auckland.

10.30 am **Morning tea**

11.00 am **The effect of fire on the design of buildings.**

Chairman
Mr G W Anderson, Assistant Director, Commonwealth Experimental Building Station, Sydney.

Speakers
Dr M Lay, BHP Research Laboratories, Melbourne.
Mr D Sfintesco, Director of Research, Centre Technique Industriel de la Construction Metallique, Paris.
Prof I M Lyalin, Pro-Rektor of all All-Union Institute of Civil Engineering, Moscow.

12.30 pm **Lunch**
Wentworth Building.

2.00 pm **Design criteria and safety factors**

Chairman
Prof J W Roderick, Department of Civil Engineering, University of Sydney.

Speakers
Mr T Jumikis, Partner, Woolacott, Hale, Corlett and Jumikis, Sydney.
Mr L E Robertson, Partner, Skilling and Robertson, Structural Designers of the World Trade Centre, New York.

3.30 pm **Afternoon tea**

4.00 pm **Limit state philosophy loads.**

Chairman
Dr F A Blakey, Assistant Chief, CSIRO Division of Building Research, Melbourne.

Speakers
Prof K L Stevens, Department of Civil Engineering, University of Melbourne.
Dr J Nutt, partner, Ove Arup and Partners, Structural Engineers, Sydney.

5.45 pm **Conference Dinner**
Union Building

6.45 pm Speaker
Prof D Winston, Department of Town and Country Planning, University of Sydney.

Thursday, 16 August 1973

PLANNING OF TALL BUILDINGS

9.00 am **The economics of tall buildings**

Chairman
Prof G E Roberts, School of Architecture, University of New South Wales.

Speakers
Mr C F Moore, Managing Director, Lend Lease Development, Sydney.
Mr G Clarke, Managing Director, Urban Systems Corporation, Sydney.

10.30 am **Morning tea**

11.00 am **The environment of tall buildings**

Chairman
Prof R N Johnson, School of Architecture, Ur sity of Sydney.

Speakers
Mr R M Aynsley, Department of Archite Science, University of Sydney.
Mr R M Hall, School of Behavorial Scie Macquarie University, Sydney.
Mrs Judith O'Neill, Brotherhood of St Laur Melbourne.

12.30 pm **Lunch**
Wentworth Building.

INTERESTING TALL BUILDINGS IN AUSTR/ AND NEW ZEALAND

Case histories of important buildings, related by designers, and followed by discussion.

2.00 pm Chairman
Prof F S Shaw, Consulting Structural Engineer.

Speakers
Mr N Abdallah, Civil and Civic Pty Ltd, Sydne
Mr David C Taylor, W P Brown and Associ. Melbourne
Mr J Payton, J Connell and Associates, Melbou
Mr J Fowler, Irwin and Johnson, Melbourne.

3.30 pm **Afternoon tea**

4.00 pm Chairman
Mr W Bunning, Architect, Sydney.

Speakers
Mr M Garnett, Rankine and Hill, Sydney.
Mr P O Miller, Miller, Milston and Ferris, Sydney.
Mr I G Smith, Bricknell, Moss, Rankine and Hill, Wellington, New Zealand.
Mr A. Wargon, Wargon, Chapman and Associates, Sydney.

5.30 pm **End of conference session.**

Friday, 17 August 1973

SYSTEMS FOR TALL BUILDINGS

9.00 am **Service systems**

Chairman
Mr K Cavanagh, Director of the Cement and Concrete Association of Australia, Sydney.

Speakers
Mr R Baum, Jaros, Baum and Bolles, Consulting Mechanical Electrical Engineers for the World Trade Centre, New York.
Mr D Norman, Norman, Disney and Young, Con- dney.

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Civil
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IRO,

Mr J Rankine, Rankine and Hill, Structural Engineers, Sydney.

More than twenty distinguished overseas specialists on the design of tall buildings have expressed their interest to attend the conference. Since the actual attendance is not known at present, the organizing committee is allocating an open session during which as many as possible will address the conference. This session may continue beyond 5.30 pm, and it may resume after dinner. A detailed programme for the open session will be announced prior to or during registration.

Conference Brochure

Department of
Architectural Science
University of Sydney
NSW 2006 Australia

International Association
for Bridge and
Structural Engineering

Institution of Engineers,
Australia

Australian and New Zealand Conference on the

Planning and Design of Tall Buildings

Sydney, 14 th to 17 th August, 1973

Sponsored by:
The Institution of Engineers, Australia
The International Association for Bridge and Structural Engineering
The New Zealand Institution of Engineers
The University of Sydney

AUSTRALIAN AND NEW ZEALAND CONFERENCE ON THE PLANNING AND DESIGN OF TALL BUILDINGS

Lunch Voucher
Wednesday, 15 August, 1973

AUSTRALIAN AND NEW ZEALAND CONFERENCE ON THE PLANNING AND DESIGN OF TALL BUILDINGS

Fruit Drinks, Coffee, Tea
Wednesday, 15 August, 1973

AUSTRALIAN AND NEW ZEALAND CONFERENCE ON THE PLANNING AND DESIGN OF TALL BUILDINGS

Lunch Voucher
Thursday, 16 August, 1973

AUSTRALIAN AND NEW ZEALAND CONFERENCE ON THE PLANNING AND DESIGN OF TALL BUILDINGS

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Fruit Drinks, Coffee, Tea
Friday, 17 August, 1973

AUSTRALIAN AND NEW ZEALAND CONFERENCE ON THE PLANNING AND DESIGN OF TALL BUILDINGS

Conference Dinner

Union Building

Wednesday, 15 August, at 5.45 pm

AUSTRALIAN AND NEW ZEALAND CONFERENCE ON THE PLANNING AND DESIGN OF TALL BUILDINGS

Cocktail Party

Wentworth Building

Tuesday, 14 August, at 5.30 pm

CONFERENCE BROCHURE

AUSTRALIAN AND NEW ZEALAND CONFERENCE ON THE PLANNING AND DESIGN OF TALL BUILDINGS

SYDNEY, AUGUST 1973

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PREVIOUS CONFERENCES HELD UNDER THE AUSPICES OF THE ASCE-IABSE JOINT COMMITTEE ON TALL BUILDINGS

Paris, January 1971
Bled, Yugoslavia, May 1971
Tokyo, September 1971
Prague, September 1971
Moscow, October 1971
Chicago, November 1971
Delft, May 1971
International Conference, Lehigh University, Bethlehem, USA, August 1972
Warsaw, November 1972
Delhi, January 1973
Mexico, March 1973
Bratislava, Czechoslovakia, April 1973

FUTURE CONFERENCES SCHEDULED UNDER THE SAME AUSPICES:

Hong Kong, 20-22 August 1973
Tokyo, 28-30 August 1973
Madrid, 17-18 September 1973
Zurich, 19-20 October 1973
Paris, 27-28 October 1973
Sorrento, Italy, 31 October 1973
Porto Allegre, Brazil, 2-5 December 1973
Cairo, 14-17 January 1974
Bangkok, 23-25 January 1974

ACKNOWLEDGEMENTS

The Conference Organizing Committee would like to thank both Trans-Australia Airlines and Qantas Airways Limited for their contributions toward the preparation and printing of the Conference Prospectus, and general assistance as official Australian and overseas carriers for the Conference.

The Conference Organizing Committee also extends its thanks to Mr P Mehaffey and Dr F Blakey for their help in arranging the tours of tall buildings in Sydney and Melbourne.

Editors

Mr R M Aynsley
Mr W Julian

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AUSTRALIAN AND NEW ZEALAND CONFERENCE ON THE PLANNING AND DESIGN OF TALL BUILDINGS

Professor H J Cowan
Department of Architectural Science
University of Sydney
Sydney 2006 Australia

I would like to order the Proceedings of the Australia and New Zealand Conference on the Planning and Design of Tall Buildings, August, 1973. I understand that the proceedings are to be printed by the Joint ASCE-IABSE Committee on Tall Buildings, in the United States, that the cost will be $A8-10, and that I will be invoiced after publication.

Charge to:

Name: ______________________

Address: ______________________

____

Mailing Label:

Please give your full postal address, including Australia or New Zealand (Proceedings will be posted in the USA)

Post to:

Name: ______________________

Address: ______________________

____

Please return both parts.

AUSTRALIAN AND NEW ZEALAND CONFERENCE ON THE PLANNING AND DESIGN OF TALL BUILDINGS

A conference on the planning and design of tall buildings will be held in the Stephen Roberts Theatre of the University of Sydney. It will be concerned mainly with structure, but it will in addition deal with the numerous other problems which need to be considered in the design of tall buildings, and which tall buildings create for their environment.

The Opening Session surveys the entire problem in broad terms. The four sessions on Wednesday consider the effects of dead and live loads, wind, earthquake and fire, the design criteria used to ensure safety, both for elastic and for limit-state design. The Thursday morning sessions deal with planning problems, ie when are tall buildings economical for the entrepreneur and for the community, what is the effect of tall buildings on the physical environment of the city, and what are the social problems created by tall buildings. Thursday afternoon is devoted to a discussion of eight of the most noteworthy tall buildings in Australia and New Zealand. The first three sessions on Friday deal with systems analysis, with special reference to new ideas on the design of the structure and the services. From 4.00 pm on Friday, continuing after dinner, if need be, we will give those of our overseas visitors who have not been able to speak earlier, an opportunity to talk about their work. We expect a substantial number of eminent engineers from overseas.

CONFERENCE AIMS

The aim of this Conference is to provide a forum for those persons involved in the planning and design of tall buildings. Both local and international authorities will be present so that differences between Australian and New Zealand and overseas practice can be put in perspective. It is intended that the papers to be presented and the following discussion will have a major impact on the improvement of the quality, livability and economy of tall buildings; thus, the Conference should appeal to structural, mechanical and electrical engineers as well as to architects, planners and builders.

CONFERENCE PROCEEDINGS

The conference papers listed below will be preprinted and issued during registration. In addition, some of the discussion will be preprinted and issued at the same time. The entire proceedings of the conference, including the prepared and the free discussion, will be published as a single volume, which is expected to run to about 800 pages. The proceedings will be compiled by the Organizing Committee and printed by the ASCE-IABSE Joint Committee in Bethlehem, USA. You may order the post-conference proceedings on this form, or before the conclusion of the conference, at a reduced price (equal to the cost of printing the extra copies, estimated at $8 - $10, including postage). Copies may also be ordered after the conference, at the normal price.

DISCUSSION

Approximately one third of each session will be allocated to the presentation of the preprinted papers, one third to prepared discussion, and one third to free discussion.

You are invited to indicate your desire to contribute to the prepared discussion on the registration form, and you may prepare a written statement which will be distributed prior to the conference session. You will then be allowed five minutes for presenting your contribution. You will also be allowed five minutes for a contribution to the free discussion. The discussion will be recorded and published; however, you should, wherever possible, submit a written version of your contribution to ensure correct reproduction.

EXHIBITION

An exhibition on tall buildings in Australia and New Zealand will be arranged in the foyer of the Stephen Roberts Theatre, and remain open throughout the conference. Associate Professor P R Smith, Department of Architectural Science, University of Sydney, would welcome offers of suitable photographs, appropriately mounted, for inclusion in the exhibition.

CONFERENCE FEES

The conference fee of $60 includes the pre-prints, the cocktail party on Tuesday evening, the conference dinner (including wines and pre-dinner drinks) on Wednesday evening, all lunches and morning and afternoon teas. A fee of $10 is payable for ladies wishing only to attend the cocktail party and dinner.

The fee of $6 for the visits to tall buildings in Melbourne and in Sydney includes transport and lunch.

A special conference fee of $15 is available to full-time students of engineering or architecture who apply for registration. This fee includes the preprints, morning and afternoon teas and lunches, but not the dinner or cocktail party.

In addition, foreign students who are in Australia under one of the aid programmes administered by the Commonwealth Department of Science and Education may apply to that Department for a travel allowance and for payment of the conference fee.

AUSTRALIAN AND NEW ZEALAND CONFERENCE ON THE PLANNING AND DESIGN OF TALL BUILDINGS

CONTRIBUTION TO THE DISCUSSION

Title of Session ______________________

Time of Session ______________________

Title of Contribution ______________________

Name of Contributor ______________________

Full Postal Address of Contributor ______________________

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AUSTRALIAN AND NEW ZEALAND CONFERENCE ON THE PLANNING AND DESIGN OF TALL BUILDINGS

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CONTRIBUTION TO THE DISCUSSION

Title of Session ______________________

Time of Session ______________________

Title of Contribution ______________________

Name of Contributor ______________________

Full Postal Address of Contributor ______________________

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CONTRIBUTIONS TO THE DISCUSSION

If you wish to contribute to the discussion, please advise the chairman as soon as possible. The chairman will give preference to those who have notified him before the beginning of the session. However, free discussion without notice is permitted subject to time being available. Whether you have given prior notice or not, please state clearly at the beginning of your speech your full name and the firm or institution with which you are associated.

We are anxious to record the discussion as fully as possible. We are relying on you to write out your discussion, and we ask you to do so in accordance with the sheet attached. You may edit your contribution for the written record, but please do not alter its original meaning. We must have your camera-ready copy not later than 10th September, 1973. Please send it to Professor H J Cowan, Department of Architectural Science, University of Sydney, Sydney, 2006, Australia.

Please complete also the attached slip, so that we may know that you intend to send us your contribution.

If you wish to do so, you may write out your contribution to the discussion prior to the meeting, duplicate it and distribute it to those present. The attendant will do this for you, or you may leave the copies on the table outside the meeting room.

FACILITIES AND SERVICES AVAILABLE FOR CONFERENCE PARTICIPANTS

Telephones

Public telephones are available in the Student Union Wentworth Building - see the map of the University Campus.

There are additional public telephones outside the Stephen Roberts Theatre, and on the ground floor of the Carslaw Building, which is adjacent to the Conference theatre.

Notice Boards

Notice boards indicating any changes in the Conference programme will be located in the lobby of the Department of Architectural Science and in the Stephen Roberts Lecture Theatre lobby.

Incoming Messages

Any incoming messages should be telephoned to the Department of Architectural Science and these will be available from the Department or from the attendants at the Conference. The Department is located at 118 City Road, Darlington - see map at end of brochure. Telephone numbers are 660 0522, extension 2686 or 2849, and 660 8686 or 660 8849.

Post Office

A post office is on campus and conducts business normally conducted by post offices. The location of the post office is indicated in the campus map.

Student Unions (Wentworth Building)

These will be open for use by those attending the conference and provide facilities such as showers, toilets, newspapers, a newsagency, public telephones, eating facilities, a pharmacy and banks.

Banks

These are to be found in the Student Union buildings, except for the University Branch of the Commercial Banking Company of Sydney, the location of which is shown in the map.

Foreign exchange conversion facilities are available in the Banks - viz the CBC and the Commonwealth Bank.

Transport to City

A number of bus routes pass the University. On City Road routes are Nos 422, 423, 426 and 448. These travel to Circular Quay via Castlereagh Street returning via Pitt Street.

Buses travelling to the city along Parramatta Road are Nos 430, 438 and 440, which proceed to and return from Circular Quay via George Street.

The University of Sydney is approximately 2 miles from the Central Business District of the City. The Taxi fare is approximately $1.20 to $1.50.

A fast underground railway loop operates around the city, which is indicated on the map supplied.

Places of Interest

Places of interest to visitors around Sydney are described on the tourist map. Organized tours are available, details of which are given elsewhere in this brochure.

Organizing Committee of the Australia and New Zealand Conference on the Planning and Design of Tall Buildings

G W Anderson (Commonwealth Experimental Building Station, Sydney), **R M Aynsley** (University of Sydney), **F A Blakey** (Division of Building Research, CSIRO, Melbourne), **J. Brotchie** (Division of Building Research, CSIRO, Melbourne), **K Cavanagh** (Cement and Concrete Association, Sydney), **H J Cowan** (Chairman) (University of Sydney), **A. Funnell** (University of Sydney), **J S Gero** (Vice-Chairman) (University of Sydney), **A S Hall** (University of New South Wales), **R D Henderson** (Institution of Engineers, Australia), **W Julian** (University of Sydney), **M Lay** (BHP Research Laboratories, Clayton, Victoria), **P Mehaffey** (Cement and Concrete Association, Sydney), **J Metcalfe** (University of Sydney), **J Nutt** (Ove Arup and Partners, Sydney), **D J O'Loughlin** (Civil and Civic Pty Ltd, Sydney), **J Rankine** (Rankine and Hill, Sydney), **F S Shaw** (Sydney), **R Shepherd** (University of Auckland, NZ), **I Smith** (Brickell, Moss, Rankine and Hill, Wellington, NZ), **P R Smith** (University of Sydney), **R G Smith** (University of Sydney), **E R Taylor** (Taylor, Thomson and Whitting, Sydney), **A Wargon** (Wargon and Chapman, Sydney).

Steering Group of the Joint Committee on the Planning and Design of Tall Buildings of the American Society of Civil Engineers and the International Association for Bridge and Structural Engineering

L S Beedle (Lehigh University, USA, Chairman), **H J Cowan** (Sydney University, Australia), **G F Fox** (Secretary, US Group of IABSE), **J M Garrelts** (IABSE Commission I, Columbia University, New York), **M P Fox** (National Science Foundation, USA), **K S Hilligan** (American Iron and Steel Institute), **T R Higgins** (Consulting Engineer, USA), **B G Johnston** (University of Arizona, USA), **T C Kavanagh** (US National Committee of CIB), **F R Khan** (Chicago High-Rise Building Committee), **L W Lu** (Lehigh University, USA, Secretary), **C Massonet** (IABSE Commission II, University of Liege, Belgium), **J McArthur** (American Institute of Architects), **W A Milek** (American Institute of Steel Construction), **T Naka** (University of Tokyo, Japan), **E O Pfrang** (National Bureau of Standards, USA), **R C Reese** (American Concrete Institute), **L Robertson** (Consulting Engineer, USA), **D Sfintesco** (Director, Centre Technique Industriel de la Construction Metallique, France, Vice-Chairman), **E K Tomby** (President, US Group of IABSE), **I M Viest** (American Society of Civil Engineers), **G Wastlund** (IABSE Commission III, Kungle, Tekniska Hogskolan, Sweden).

TOURS

It is expected that some members of the Conference may wish to participate in these tours with their wives and indeed it is hoped that they will avail themselves of this opportunity. A carefully selected programme is offered, providing variety, a maximum in enjoyment and an understanding of the Australian people.

CT6 CITY SIGHTS

PRICE $3.75
OPERATES 9.15 am to 12.15 pm

This tour takes you through the Rocks Area, Argyle Place, plast the Garrison Church and under the Harbour Bridge to view the legendary "Pinchgut" (Fort Denison) on to the Opera House, Botanic Gardens, Art Gallery and Lady Macquarie's Chair. Travelling through Queen's Square and Kings Cross you come to Double Bay, Rose Bay and Watsons Bay. We inspect Vaucluse House, the home of W.C. Wentworth (entry fee extra), before returning to the city via the Southern Beaches.

CT7 NORTHERN BEACHES AND PITTWATER CRUISE

PRICE $4.30
OPERATES 1.30 pm to 5.30 pm

Your coach travels over Sydney Harbour Bridge to The Spit, through the Northern Beaches of Manly, Freshwater, Collaroy, Narrabeen, Warriewood, Mona Vale to Newport. On arrival at Newport we join the water vessel "Raluna" for a 35 minute cruise from Newport to Palm Beach viewing some of Sydney's finest waterfront homes. A full commentary is given while aboard. Devonshire tea is served on board (not included). On arriving at Palm Beach we rejoin our Panther Coach and return to Sydney via Frenchs Forest, Roseville Bridge and the historic Northbridge.

CT8 KATOOMBA AND BLUE MOUNTAINS

PRICE $6.25
OPERATES 9.30 am to 6.00 pm

A magnificent day tour takes you through Parramatta, Penrith, Nepean River and Springwood (an old town on the Blue Mountains), through Lawson, Wentworth Falls to Leura and Katoomba, where lunch is available (extra). The breathtaking sight of the Three Sisters, Echo Point and Cliff Drive with glorious views of the Megalong Valley from the scenic railway and skyway cable car, 750 feet above the Jamison Valley, are sights that you will always remember. The tour continues through Medlow Bath, which is the highest town in the Blue Mountains and 3,495 above sea level. The tour returns via Kurrajong Heights, Hawkesbury Valley and other points of interest.

CT9 SYDNEY HARBOUR CRUISE

PRICE $4.00
OPERATES 9.30 am to 12.00 noon
12.30 pm to 3.00 pm

The "Aqua Cruise" shows you Sydney at its best. Sydney is built on one of the largest and most beautiful harbours in the world. The cruise takes you under the Harbour Bridge and past Goat Island, Greenwich Point, Balls Head, Shell Cove, Middle Harbour, Manly, Watsons Bay, Double Bay, Farm Cove and many Harbour beaches. This cruise is a photographers dream crowned by a cruise past the internationally famous Opera House. On board you have the choice of tea, coffee or drinks from the bar.

TAA is pleased to be the Official Travel Consultant to the Australian and New Zealand Conference on the Planning and Design of Tall Buildings.

TAA convention Advisers offer friendly way personalised attention for all your travel arrangements and touring.

International delegates please write to:-

Congress Tours Officer,
Tall Buildings Conference
Box 4230, GPO
SYDNEY, NSW 2001

In Australia contact any of the TAA Convention Advisers:-

MELBOURNE	Mrs Meg Allen	34 0333
SYDNEY	Mr Gilbert Buhagiar	2 0326
CANBERRA	Mrs Carrolle Marshall	48 8433
BRISBANE	Mr Stephen Grieve	33 2011
ADELAIDE	Mr George Furbow	51 0101
PERTH	Miss Mary Hodgkinson	23 0331
HOBART	Mr Ron Fellow	34 4411
LAUNCESTON	Miss Rosemary Joscelyne	2 2321
TOWNSVILLE	Mr Don Hammett	71 6081
PORT MORESBY	Mr Cec Rycen	2131

ABOUT THE TOURS

The following tours have been especially planned to enable you to see Australia as it is —a big country, full of contrast and striking natural beauty. The tours have been planned by the official Conference Domestic Airline TAA — Trans Australia Airlines, Australia's largest Domestic Airline.

RESERVATIONS PROCEDURE FOR TOURS

All Qantas offices and major Travel Agencies throughout the world are familiar with the tours and travel arrangements for the Conference. You may book your tours with them or indicate which tours you require when completing your registration form. International agents should direct bookings through Qantas to "SYDRRTN ATTENTION TALL BUILDINGS CONFERENCE".

TOUR PRICES INCLUDE

The cost of tours is not subject to alteration if Registrants make pre payment when completing the registration form. Those booked after that date would be subject to alteration.

CT1 **7 DAY BARRIER REEF**

PRICE $265 per person
DEPARTS Saturday 4 August, 1973
Saturday 18 August, 1973

Price includes TAA T-Jet to Mackay for the start of your four day cruise of the Whitsunday Islands on the comfortable 112 foot cruiser Esmeralda. You visit Brampton, Long, South Mole, Hayman Islands to name just a few. Cruise then to Lindeman Island for two nights in the Lindeman suites. Complete your holiday with your TAA Flight homeward from Mackay.

CT2 **8 DAY CENTRAL AUSTRALIA KINGS CANYON, AYERS ROCK, ALICE SPRINGS**

PRICE $338 per person
DEPARTS Saturday 4 August, 1973
Saturday 18 August, 1973

Price includes TAA T-Jet to Alice Springs, and accommodation at Elkira Court, the Oasis or the Territory Hotel Motel. Tours take you to Stanley Chasm, Simpsons Gap, Ayers Rock, Finke and Palmer Rivers, the Olgas, Wallara Ranch, Kings Canyon and many others. Returning to Sydney by TAA on the following Saturday.

CT3 **WEEKEND WREST POINT CASINO — HOBART**

PRICE $121 per person, share twin. Single accommodation is available — surcharge on application.
DEPARTS Saturday 11 August, 1973
Saturday 18 August, 1973

Price includes return TAA T-Jet travel to Hobart, two nights accommodation in the comfortable Seaview Wing of Wrest Point Casino.

CT4 **7 DAY AUSTRALIA'S GOLD COAST**

PRICE $92 per person, share twin Motel
$110 per person, share twin Apartments
$97 per person, share twin Hotel
DEPARTS Saturday 4 August, 1973
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AUSTRALIAN AND NEW ZEALAND CONFERENCE ON THE PLANNING AND DESIGN OF TALL BUILDINGS

CHAIRMAN'S INTRODUCTION

This conference is concerned primarily with the structure of tall buildings. Professor Beedle will review this subject in the Invitation Address on Tuesday, 14th August. The four sessions on Wednesday, 15th August, deal with the limitations on the design of tall buildings. Professors Vickery, Rosenblueth and Shepherd will discuss the effect of wind and earthquakes. As buildings get taller it becomes more important to consider their behaviour under dynamic loading. Australian designers are getting concerned about earthquakes which have in the past been considered a problem only New Zealanders need worry about. Wind loads have also now reached the stage where it is no longer sufficient to take them as equivalent to static horizontal forces. Damping may need to be provided for in the design of the structural frame, or at least it may reduce the height premium.

The effect of fire will be discussed by Dr Lay, Mr Sfintesco and Professor Lyalin. Australia has one of the most severe set of fire regulations for the design of tall buildings anywhere in the world. Fires certainly do occur in tall buildings, and the consequences of one getting out of hand could be as awful as a major earthquake. Nevertheless it is possible for regulations to be too severe, and we cannot escape the conclusion that either our regulations are too severe, or else that some other countries are taking some frightful risks.

In the two afternoon sessions, Mr Robertson, Mr Jumikis, Professor Stevens and Dr Nutt will consider design loads, safety factors, and design by elastic criteria and by limit states philosophy. The 2.00 pm session will be devoted mainly to elastic procedures, and the 4.00 pm session mainly to ultimate strength.

In the evening, after the conference dinner, Professor Winston will talk about tall buildings from a town planner's point of view.

Planning will also be the topic on Thursday morning. A tall building must be an economically sound proposition, whether it is built by private enterprise or by a public authority, otherwise it will not be built at all. The developer, whether private or public, must accept responsibility for the consequences of creating a tall building, particularly for the increased traffic generated by the new population density. The problem of building economics will be debated by Mr Moore and Mr Clarke.

In the second session on Thursday, Mr Aynsley deals with the secondary, but no less important problems of the external physical environment, such as undesirable wind effects; and Mr Hall and Mrs O'Neill deal with the internal environment of tall office buildings and of tall residential buildings. In spite of the success of tall buildings for housing offices and high-cost flats or home units, we may have to face the fact that tall buildings may just not be suitable for low-cost housing.

On Thursday afternoon we have invited eight leading structural designers to talk about their tall buildings, followed by ample time for discussion. It is difficult to pick eight people when there are so many to choose from, and I hope you will agree that the Organizing Committee did its best. These two sessions will not merely produce a discussion of the most interesting tall buildings in Australia and New Zealand, including any that discussion speakers may wish to introduce, but we hope through the post-conference proceedings to feed this information into the international monograph on tall buildings which will be published following the present series of regional conferences on tall buildings.

On Friday we propose to discuss systems for tall buildings. At 9.00 am Mr Baum and Mr Norman will talk about service systems. At 11.00 am Mr Iyengar and Mr Gero will discuss structural systems, and at 2.00 pm Dr Reinschmidt and Dr Brotchie will consider environmental systems and systems methodology. In each case there will be an opportunity to contrast American and Australian practice, and there are obvious differences which require elucidation.

At 4.00 pm, we have an open session which will afford us an opportunity to hear from those of our distinguished overseas visitors who are not scheduled elsewhere in the programme. We will issue a list of the papers to be presented later, when all the information is available. If necessary, we will extend this session beyond dinner time, to allow enough time for our learned guests and for your questions and discussion.

May I now briefly outline the general procedure. The invited speakers have been allotted 15 minutes to present their pre-printed papers. This will take up about a third of each session. We have indicated that another third of the session will be given over to prepared discussion. You are invited to indicate your desire to contribute to this prepared discussion, and you may prepare a written statement which you may give to us for distribution prior to the conference session. If you are notified to contribute orally to the prepared discussion, please come to the platform when called by the chairman, and deliver your address (not more than five minutes, please) from one of the two desks. The white light will tell you that you have one minute left to go, and the red light that your time is up and you must now stop.

The remaining third of the session is reserved for free discussion and questions. Several attendants will hand out microphones. Please be at a microphone when you catch the chairman's eye, but do not come up to the platform. The time limit is five minutes, but if you can be briefer, we can hear from more people.

We shall have a shorthand writer, and we shall also have a tape recorder; but recording the discussion correctly is always a difficult task. We would prefer to rely on your own account of what you said, and use the record merely as a check. There is a statement in this brochure on the manner in which you are asked to submit your contribution to the discussion for publication. Please send us a typescript on quarto or A4 paper, which is suitable for photographic reproduction, and please do not send us more than five pages, including illustrations and references.

You may order the full conference proceedings on the form enclosed in this brochure. The cost will be approximately $8 - $10. Please do not send any money. You will be invoiced when the exact cost is known. You may also obtain the proceedings at a higher price by ordering after the conference, provided there are sufficient copies available.

Finally, I would like to thank my colleagues and students from the Department of Architectural Science who have borne the burden of mounting this conference:

Mr John Gero, Vice-Chairman of the Organizing Committee, and Chairman of Sub-Committee on Lecture Rooms, Meals and Transport.

Mr Dick Aynsley, Chairman of Sub-Committee on Printing, Accommodation and Conference Secretariat.

Professor Peter Smith, Chairman of the Exhibition Sub-Committee.

Mr Warren Julian, Chairman of Sub-Committee for Audio-Visual Aids and for the Recording of the Discussion.

Dr Jack Metcalfe, Chairman of Publicity Committee, and many others who have helped.

I would like to thank the administrative staff of the University of Sydney for their assistance, our co-sponsors for providing publicity and for much help and advice, and the members of the conference organizing committee and of the International Steering Group for their wise counsel. I hope you will enjoy the conference as much as we are enjoying preparing for it.

Henry J Cowan
Chairman, Conference Organizing Committee

Mr M Garnett
Rankine and Hill, 3 West Street, North Sydney, NSW, 2060

Mr J S Gero
Department of Architectural Science, University of Sydney, NSW, 2006

Mr R M Hall
School of Behavioural Sciences, Macquarie University, Balaclava Road, North Ryde, NSW, 2113

Mr H Iyengar
Skidmore Owings and Merrill, 30 West Monroe Street, Chicago, Ill 60603, USA

Mr. T. Jumikis
Woolacott, Hale, Corlett and Jumikis, 69 Berry Street, North Sydney, NSW, 2060

Dr M Lay
BHP Research Laboratories, 254-273 Wellington Road, Clayton, Vic, 3131

Professor I M Lyalin
Serenevii Brd 43, Kv 34, Moscow, E-215, USSR

Mr. P O Miller
Miller, Milston and Ferris, 18 Argyle Street, Sydney, NSW, 2000

Mr C F Moore
Lend Lease Development, Australia Square, George Street, Sydney, NSW, 2000

Mr D Norman
Norman, Disney and Young, 48 Chandos Street, St Leonards, NSW, 2065

Dr J Nutt
Ove Arup and Partners, 122 Walker Street, North Sydney, NSW, 2060

Mrs Judith O'Neill
Brotherhood of St Laurence, Brunswick Street, Fitzroy, Vic, 3065

Mr J Peyton
J Connell and Associates, 400 St Kilda Road, Melbourne, Vic, 3004

Associate Professor K Reinschmidt
Department of Civil Engineering, Room 1-230, Massachusetts Institute of Technology, Cambridge, Mass 02013, USA

Mr L E Robertson
Skilling and Robertson, 230 Park Avenue, New York, NY 10017, USA

Dr E Rosenblueth
Director, Instituto de Ingeniera, Cuidad Universitaria, Mexico 20 DF, Mexico

Mr D Sfintesco
C T I C M, 20 Rue Jean Jaures, 92 Puteaux, France

Associate Professor R Shepherd
Department of Civil Engineering, University of Auckland, Private Bag, Auckland, New Zealand

Mr I C Smith
Bricknell, Moss, Rankine and Hill, Shell House, The Terrace, Wellington, New Zealand

Professor L K Stevens
Department of Civil Engineering, University of Melbourne, Parkville, Vic, 3052

Mr David C Taylor
W P Brown and Associates, PO Box 201, Hawthorn, Vic, 3122

Associate Professor B J Vickery
Department of Civil Engineering, University of Sydney, NSW, 2006

Mr A Wargon
Wargon, Chapman and Associates, 155-159 Castlereagh Street, Sydney, NSW, 2000

SESSION CHAIRMEN

OPENING SESSION:

Professor A H Corbett, President of the Institution of Engineers, Australia

LIMITATIONS OF DESIGN OF TALL BUILDINGS:

Mr N Sneath, Assistant Director-General (Structural) Commonwealth Department of Works, Melbourne
Mr G W Anderson, Assistant Director, Commonwealth Experimental Building Station, Sydney
Professor J W Roderick, Department of Civil Engineering, University of Sydney
Dr F A Blakey, Assistant Chief, CSIRO, Division of Building Research, Melbourne

PLANNING OF TALL BUILDINGS:

Professor G E Roberts, School of Architecture, University of New South Wales
Professor R N Johnson, School of Architecture, University of Sydney

INTERESTING TALL BUILDINGS IN AUSTRALIA AND NEW ZEALAND:

Professor F S Shaw, Consulting Structural Engineer, Sydney
Mr W Bunning, Architect, Sydney

SYSTEMS FOR TALL BUILDINGS:

Mr K Cavanagh, Director of Cement and Concrete Association of Australia, Sydney
Mr E R Taylor, of Taylor, Thomson and Whitting, Consulting Engineers, Sydney
Dr D G Elms, Department of Civil Engineering, University of Canterbury, Christchurch, New Zealand

OPEN SESSION:

Mr J Rankine, of Rankine and Hill, Structural Engineers, Sydney.

LIST OF AUTHORS OF PAPERS

Mr N Abdallah
Civil and Civic Pty Ltd, PO Box K404, Haymarket, Sydney, NSW, 2000

Mr R M Aynsley
Department of Architectural Science, University of Sydney, NSW, 2006

Mr R Baum
Jaros, Baum and Bolles, 345 Park Ave, New York, NY 10017, USA

Professor L S Beedle
Fritz Engineering Laboratory, Lehigh University, Bethlehem, Penn 18015, USA

Dr J Brotchie
Division of Building Research, CSIRO, PO Box 56, Highett, Vic 3190

Mr G Clarke
Urban Systems Corporation Pty Ltd, MLC Building, North Sydney, NSW, 2060

Mr J Fowler
Irwin and Johnson and Partners, 78 Eastern Road, South Melbourne, Vic, 3205

CONFERENCE TOURS OF TALL BUILDINGS

MELBOURNE, Monday, 13th August 1973

This tour is organized by the Division of Building Research, CSIRO. It leaves from the Travelodge Motel, Tullamarine Airport at 9.00 am and returns to Tullamarine Airport in time for TAA flight 588 which leaves Melbourne for Sydney at 5.00 pm. You may join the tour at the BHP Theatrette, BHP House on William and Bourke Streets, at approximately 9.25 am, and you may leave the tour in the centre of Melbourne before the coach leaves for the airport. The cost is $6.00, including transport and lunch.

SYDNEY, Tuesday, 14th August 1973

This tour is organized by the Cement and Concrete Association of Australia. It leaves from St Johns College, University of Sydney, at 9.00 am, and the Motel University, Parramatta Road, Camperdown, at 9.10 am. Alternatively, you may join the tour at 9.40 am at the Australia Square Tower, in front of the lift for the Skywalk on level 4. The coach will return to the University at 2.40 pm in time for the opening session at 3.00 pm. The cost is $6.00 including transport and lunch.

CONFERENCE PROGRAMME

Monday, 13 August 1973

TOUR OF TALL BUILDINGS IN MELBOURNE

9.00 am
Organized by the Division of Building Research, CSIRO. Cost $6, including transport and lunch. Leave from the Travelodge Motel, Tullamarine at 9.00 am and finish at Tullamarine Airport in time for TAA flight 588, at 5.00 pm for Sydney.

Tuesday, 14 August 1973

TOUR OF TALL BUILDINGS IN SYDNEY

9.00 am
Organized by the Cement and Concrete Association of Australia.
Cost $6, including transport and lunch.
The tour will leave from St Johns College, University of Sydney at 9.00 am, and finish at the University of Sydney in time for the opening session.

3.00 pm
OPENING SESSION

Chairman
Prof A H Corbett, President of the Institution of Engineers, Australia.

Opening of the Conference

The Rt Hon The Lord Mayor of Sydney
Alderman David Griffin CBE

Welcome

Prof W M O'Neil, Acting Vice-Chancellor of the University of Sydney.

Keynote Address

Prof H J Cowan, Chairman of the Conference Organizing Committee.

Invitation Lecture

Prof L S Beedle, Chairman of the Joint Committee on Tall Buildings of the American Society of Civil Engineers and the International Association for Bridge and structural Engineering, and Professor of Civil Engineering at Lehigh University, Bethleham, USA.

5.30 pm
Cocktail Party
Wentworth Building.

Previously scheduled Sub-Committee Meetings have been cancelled due to lack of interest.

Wednesday, 15 August 1973

LIMITATIONS ON THE DESIGN OF TALL BUILDINGS

9.00 am
The effect of wind and earthquakes on the design of tall buildings.

Chairman
Mr N Sneath, Assistant Director-General (Structural), Commonwealth Department of Works, Melbourne.

Speakers
Assoc Prof B J Vickery, Department of Civil Engineering, University of Sydney.
Dr E Rosenblueth, Director Instituto de Ingenieria, National Autonomous University of Mexico.
Assoc Prof R Shepherd, Department of Civil Engineering, University of Auckland.

10.30 am
Morning tea

11.00 am
The effect of fire on the design of buildings.

Chairman
Mr G W Anderson, Assistant Director, Commonwealth Experimental Building Station, Sydney.

Speakers
Dr M G Lay, BHP Research Laboratories, Melbourne
Mr D Sfintesco, Director of Research, Centre Technique Industriel de la Construction Metallique, Paris.
Prof I M Lyalin, Pro-Rektor of all All-Union Institute of Civil Engineering, Moscow.

12.30 pm
Lunch
Wentworth Building.

2.00 pm
Design criteria and safety factors

Chairman
Prof J W Roderick, Department of Civil Engineering, University of Sydney.

Speakers
Mr T Jumikis, Partner, Woolacott, Hale, Corlett and Jumikis, Sydney.
Mr L E Robertson, Partner, Skilling and Robertson, Structural Designers of the World Trade Centre, New York.

3.30 pm
Afternoon tea

4.00 pm
Limit state philosophy loads.

Chairman
Dr F A Blakey, Assistant Chief, CSIRO Division of Building Research, Melbourne.

Speakers
Prof L K Stevens, Department of Civil Engineering, University of Melbourne.
Dr J Nutt, partner, Ove Arup and Partners, Structural Engineers, Sydney.

5.45 pm
Conference Dinner
Union Building

6.45 pm
Speaker
Prof D Winston, Department of Town and Country Planning, University of Sydney.

A Coordinated Building Design System

Kenneth F Reinschmidt
Associate Professor of Civil Engineering, MIT Cambridge, Massachusetts, USA

Alan D Russell
Department of Civil Engineering, MIT Cambridge, Massachusetts, USA

A modern building is a complex system in which the performance of numerous subsystems must be integrated. To achieve optimal system performance and cost, the design process must evaluate tradeoffs between the various subsystems and between initial and recurring costs.

The Coordinated Building Design System is an approach which seeks an optimal building design by quantifying these tradeoffs and rationalizing (but not automating) the process of design. The computer is used as a means of storing and processing information and as an aid to the designer by providing quantitative predictions of systems' performance and costs.

The building design process is viewed as a progressive gathering and production of information, with a corresponding reduction in the designer's uncertainty about the final configuration of the building, its performance, and its cost. A measure of uncertainty is associated with each building design parameter; this uncertainty may be large in the preliminary design phase but continually decreases as design progresses. The figure of merit for the building design is the net present value of all future incomes and life cycle costs. This is not the total measure of the building's quality, which depends on aesthetic, social, and many other factors, but it is useful because it is objective and quantifiable and thus provides an important input to the designer's evaluation. From the (subjective) estimates of uncertainty in the building design parameters, the uncertainty in the merit function can be computed, and this quantity might be used to define and direct the design process.

Obviously not all uncertainty can be eliminated in the design process, as costs for example are dependent upon future construction prices, maintenance policies, etc. The remaining uncertainty is considered by means of a utility function, which generally expresses the client's attitude toward risk. In the present approach, all uncertainties are treated by second order methods; ie means and variances.

The analysis of building performance requires predictive models suitable for computation. Computer systems for structural analysis and HVAC system simulation are widely used. Because they require the specification of a large number of design parameters and are fairly expensive to run, they are generally more useful in the detailed design stages than in concept development. A hierarchy of models can be obtained by integrating out many design parameters, resulting in models which are less accurate but which require less input information, and are therefore more suitable for design concept studies and optimization. Ultimately a spectrum of coordinated computer models can be visualized, each matched to the variable information content of the design process.

For example, a structural cost model has been derived for typical flat plate concrete apartment towers by a regression analysis of the output of a standard PCA design program. Design optimization studies have been made using this model in coordination with other programs for elevator, heating system, and foundation design.

A Systems Approach to Building Planning and Design

M P T Linzey, J F Brotchie and J F Nicholas,
Division of Building Research, CSIRO.

The design of a tall building or the results of that design are of interest not only to the building designer but also to owners, developers, town planners and politicians as well as occupiers, users and neighbours of that building, and to some extent the community as a whole. A systems approach to design sets out to identify the system, and its environment, to determine the essential features of each and define objectives and constraints.

The system may be modelled and the model manipulated to provide information that will help to satisfy objectives without violating constraints. The process of defining and modelling the system may occur at several levels from preliminary economic evaluation through to detailed design and selection of operating policies. At each level, a further definition of the system or subsystems is involved and a more detailed model is needed.

Hierarchical structuring of these models allows a coordinated approach to optimal design. The models may be manipulated to satisfy a particular party's objectives. The effects on and influences of other interested parties may also be obtained, and a design arrived at which best satisfies these various requirements, and future needs.

The effectiveness of the system to the user, and the costs in use may be viewed along with initial construction costs — and rental returns. The sensitivity of the performance of the building to various parameters and factors may be tested e.g. to economic environment, to obsolescence, to operating costs, to structural parameters and to externalities if included as system costs. The results of these studies are presented and discussed.

The paper is concerned with designing for the future, and the criteria for that design.

Structural Systems for Two Ultra High-Rise Structures

S H Iyengar, M ASCE
Associate Partner, Skidmore, Owings & Merrill
Chicago, Illinois

The paper traces the development of structural systems for two structures, the Sears Tower and the John Hancock Building, both located in Chicago, USA.

Sears Tower will be the tallest building structure when completed in 1974. The tower consists of 109 stories for an overall height of 1450 ft above ground and is based on a unique structural system called *Bundled Tube System*. The paper discusses the evolution of this Bundled Tube System for maximum structural efficiency. A special part of the development relates to the interdisciplinary co-ordination with Architectural requirements in terms of office space which has resulted in the creation of modular Step Backs. Other features presented in the paper pertain to the optimization of the overall system and structural design criteria.

The 100 story Hancock Building also uses a unique system based on a diagonally braced tubular system and represents a multiple-use building involving commercial, parking, office and apartment type occupancies. The development of this structural system will be treated with due consideration to the multiple functional requirements for effective Architectural-Structural integration.

A significant aspect of system development is the coordination of structural steel detailing concepts with the fabricators. The formation of a shop fabricated erection module for the frame played a key role in economic fabrication of steel for the Sears Tower. Similarly, the bolted field joints for the Hancock Building were instrumental in reducing the unit cost of steel. The paper will provide a brief discussion of several effects of fabrication.

The Behaviour of Building Structures under Lateral Loads

John S Gero
Senior Lecturer, Dept. of Architectural Science, University of Sydney.

The behaviour of small frames is well known in the areas of strength, stiffness and stability, however, as frames get taller and more complex many secondary factors which are normally neglected come to play an increasingly important role.

Most of the behavioural problems associated with building frames are connected with structures for tall buildings, for in these structures the effects of lateral loads increase at a faster rate than the increase in height. In tall buildings the fundamental engineering problems relate to the method of carrying vertical and lateral loads, the method of vertical transportation, and the method of air-conditioning the building, and a successful engineering solution is always one in which these three aspects are harmoniously satisfied.

This paper examines the behaviour of various tall building structures under lateral loads. The structures examined include frames, interacting frames and shear walls, *top-hat* interacting frames and shear walls and braced facade on tube structures. The effects of including not only bending deformations but also axial and shear deformations are shown as well as the effects of different assumptions made during analysis.

Graphs are presented which illustrate the significant contributions to the behaviour under lateral loads of the abovementioned variables, indicating the gross errors which result from their omission.

Additionally, design criteria are briefly summarised. Consideration is given to intergrating the structure with the architecture of the building and hence to the effects of different structural designs on the total cost of a building.

CONFERENCE PROGRAMME

Thursday, 16 August 1973

PLANNING OF TALL BUILDINGS

9.00 am
The economics of tall buildings

Chairman
Prof G E Roberts, School of Architecture, University of New South Wales.

Speakers
Mr C F Moore, Managing Director, Lend Lease Development, Sydney.
Mr G Clarke, Managing Director and **Mr K McDonald**, Urban Systems Corporation, Sydney.

10.30 am
Morning tea

11.00 am
The environment of tall buildings

Chairman
Prof R N Johnson, School of Architecture, University of Sydney.

Speakers
Mr R M Aynsley, Department of Architectural Science, University of Sydney.
Mr R M Hall, Mr T Purcell, Mr R Thorne and **Mr J Metcalfe**, School of Behavorial Sciences, Macquarie University, Sydney.
Mrs Judith O'Neill, Brotherhood of St Laurence, Melbourne.

12.30 pm
Lunch
Wentworth Building.

INTERESTING TALL BUILDINGS IN AUSTRALIA AND NEW ZEALAND

Case histories of important buildings, related by their designers, and followed by discussion.

2.00 pm
Chairman
Prof F S Shaw, Consulting Structural Engineer.

Speakers
Mr N Abdallah, Civil and Civic Pty Ltd, Sydney
Mr David C Taylor, W P Brown and Associates, Melbourne.
Mr J J Peyton, J Connell and Associates, Melbourne.
Mr J R Fowler, Irwin and Johnson, Melbourne.

3.30 pm
Afternoon tea

4.00 pm
Chairman
Mr W Bunning, Architect, Sydney.

Speakers
Mr M W Garnett, Rankine and Hill, Sydney.
Mr P O Miller, Miller, Milston and Ferris, Sydney.
Mr I C Smith, Bricknell, Moss, Rankine and Hill, Wellington, New Zealand.
Mr A Wargon, Wargon, Chapman and Associates, Sydney.

5.30 pm
End of conference session.

Friday, 17 August 1973

SYSTEMS FOR TALL BUILDINGS

9.00 am
Service systems

Chairman
Mr K Cavanagh, Director of the Cement and Concrete Association of Australia, Sydney.

Speakers
Mr R Baum, Jaros, Baum and Bolles, Consulting Mechanical Electrical Engineers for the World Trade Centre, New York.
Mr H D Norman, Norman, Disney and Young, Consulting Mechanical and Electrical Engineers, Sydney.

10.30 am
Morning tea

11.00 am
Structural systems

Chairman
Mr E R Taylor, Taylor, Thomson and Whitting, Consulting Engineers, Sydney.

Speakers
Mr S H Iyengar, Associate Partner, Skidmore, Owings and Merrill, Chicago.
Mr J S Gero, Department of Architectural Science, University of Sydney.

12.30 pm
Lunch
Wentworth Building

2.00 pm
Environmental systems and systems methodology

Chairman
Dr D G Elms, Department of Civil Engineering, University of Canterbury, Christchurch, New Zealand.
Speakers
Assoc Prof K F Reinschmidt and **Mr A D Russell**, Department of Civil Engineering, Massachusetts Institute of Technology, Cambridge, USA.
Dr J Brotchie, Mr M P T Linzey and **Mr J F Nicholas**, Division of Building Research, CSIRO, Melbourne.

3.30 pm
Afternoon tea

4.00 pm
OPEN SESSION

Chairman
Mr J Rankine, Rankine and Hill, Structural Engineers, Sydney.

More than twenty distinguished overseas specialists on the design of tall buildings have expressed their interest to attend the conference. Since the actual attendance is not known at present, the organizing committee is allocating an open session during which as many as possible will address the conference. This session may continue beyond 5.30 pm, and it may resume after dinner. A detailed programme for the open session will be announced prior to or during registration.

The Provisions & Limitations of the Australian Wind Loading Code, CA34 Pt II

Barry J Vickery
Associate Professor, School of Civil Engineering, University of Sydney

Design problems associated with wind loads on tall buildings are discussed with reference to recent approaches to the solution of these problems and the solutions implicit in the provisions of the Australian wind loading code, CA34 Pt II. Consideration is given to the following points;

1 *Design Criteria*; the definition of acceptable risks of serious damage, minor damage to cladding and finishes, perceptible acceleration levels and uncomfortable or dangerous wind speeds at ground level.

2 *Definition of Design Wind Speeds*; the prediction of upper level wind speeds from ground level gust data; the use of balloon data; the incorporation of directional effects into the design process. Design wind speeds determined from balloon data are presented for Sydney and compared with those specified in CA34.

3 *Gust Response Factors*; the use and limitations of gust response factors on the evaluation of loads on tall buildings. This section includes a comparison of the gust response and peak gust methods of evaluating wind loads. Design charts compatible with the provisions of CA34 are presented.

4 *Across-wind motions*; approximate methods of estimating the likely magnitude of across-wind deflections and accelerations are presented.

5 *The Use of the Wind Tunnel*, the use and the limitations of the wind tunnel as a design tool and as a design check for overall loads, cladding loads and ground level wind speeds. Pressure distributions and overall loads determined by means of wind tunnel testing are compared with those defined by CA34.

The Six Components of Earthquakes

Dr E Rosenblueth,
Director, Instituto de Ingenieria, Universidad Nacional Autonoma de Mexico, Mexico, DF, Mexico

Motion of a building's base is treated as that of a rigid body. Attention is paid to the corresponding six degrees of freedom. It is assumed that in each degree of freedom the base describes a motion equal to the ground surface in free field, averaged over a surface equal to that of the base. Two extreme conditions are considered: uncorrelated and totally correlated components of motion. For the latter condition rotational components are estimated in terms of the translational components under the assumption that ground motion consists either of Rayleigh, shear, or Love waves. Analyses are illustrated by means of applications to buildings idealized as uniform shear beams within the linear range of behavior. It is found that rotational components can have greater effects than usually supposed.

New Zealand Earthquake Provisions

Dr Robin Shepherd.
Associate Professor of Civil Engineering, University of Auckland

Following the 1931 Napier earthquake much attention was devoted to seismic loading in New Zealand and as a result a Standard Model Building Bylaw, incorporating a rational seismic design procedure, was first published in 1935. In the following thirty years only minor modifications to this document reflected the slow progress made in accumulating the basic information necessary to enable the inadequacies of the code to be overcome. However the improved appreciation of the dynamic nature of the problem was recognised in the current code (N Z S 1900 Chapter 8) published in 1965. A full revision has recently been completed (in March 1973) and is now being prepared for issue as a draft for public review. All comments received will be considered and changes may be made to the draft as a result of these submissions.

Although the basic aims of the code and the overall levels of required seismic resistance are essentially unchanged the revision has provided the opportunity to alter some sections of N Z S 1900, Chapter 8, 1965, namely to clarify some sections, to amend certain portions where this appears necessary in the light of recent destructive earthquakes, to revise those provisions where prescribed levels of resistance may now be better substantiated, and to introduce specific material factors.

In this paper the form of the revised New Zealand seismic loading code is outlined and the significance of the various provisions is discussed.

Mutual Influences between Building Concept and Mechanical Systems in Tall Structures

R Baum
Jaros, Baum & Bolles, Consulting Mechanical and Electrical Engineers for the World Trade Centre, New York.

This paper is devoted to the identification and examination of those features which are peculiar to tall buildings, as distinguished from buildings in general. Their impact on the engineer's role on the building planning team and on his design problems is discussed.

The characteristics of tall buildings which were selected as meaningful in this discussion include:

Physical Characteristics:

- Vertical solar patterns (except for buildings remote from other tall structures)
- Updrafts (except in warm climates)
- Susceptibility to vertical fire spread
- Comparatively high pressures in water distribution systems

Architectural Characteristics:

- Usually repetitive floor plan or floor plan types
- Core location and configuration largely a mechanical/electrical function

System Characteristics:

- Significant impact of vertical transport systems
- People transport
- Materials handling
- Impact on fire protection
- Vertical service distribution systems (cores and shafts vs. suspended ceiling cavity)
- Tendency toward few large mechanical/electrical systems vs. single floor systems.

Environmental Characteristics:

Tall, inner city buildings make possible the rejection of combustion products, odors, noxious gases heat and moisture high above street level. The diffusion possible in high strata tends to keep ground level environment relatively free of building-generated waste products.

The way in which mechanical systems are designed to respond to a tall building's functional needs is reviewed, as are the effects which mechanical requirements can exert on various requirements of the architectural and structural design.

Service Systems

H David Norman
Managing Director, Norman Disney & Young Pty Ltd, Consulting Engineers, Sydney N S W

The current technology involved in designing service systems for tall buildings in Australia is essentially an extension of the techniques that have been developed and are presently being used in medium height buildings.

This paper is intended to briefly outline the present day thinking on services to tall buildings in Australia and to illustrate the effect that building height has on the design of the various systems.

The higher penalty paid for core space in tower type structures, the higher hydraulic pressures and the maintenance and monitoring problems associated with systems in these buildings, tends to impose economical and practical operating problems of greater magnitude than in small buildings. A modification of approach therefore becomes necessary to achieve the most practical and economical service.

It it towards a discussion of these factors that this paper is directed.

The A M P Centre, Sydney

M W Garnett
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Consulting Engineers, Sydney, NSW

The Australian Mutual Provident Society (A M P) is the largest insurance company in Australia. It invests money in the construction of buildings throughout the country and is an experienced and well informed client. The Head Office building of the A M P is at Sydney Cove. Behind this building is being constructed, for the A M P an office building known as The A M P Centre.

When completed, this will be the tallest building in Australia, rising 660 ft. above ground level, offering 565,000 square feet of rentable office space, with a total project cost of about $30 million.

The structure of the building is of reinforced concrete, using both normal and light-weight concrete.

The paper will deal with general aspects of the structural engineering of the project from the initial feasibility studies and schematic investigations to final construction on site. The structural system chosen has proved to be quick and economical to construct, and is adaptable to changes which have mitigated the effects of industrial disputes.

The structure has been instrumented so that shrinkage and creep effects can be measured in the field and compared with design assumptions made in the office.

Slides will be used to illustrate the project when the paper is presented.

Qantas Centre, Sydney Design and Construction Planning

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The Qantas Centre in Sydney is a development designed to house the head office of Australia's International Airline, Qantas, and is situated on the fringe of the downtown business area. It consists of a very large podium structure buried deep into Sydney's sandstone, which contains a major computer facility, topped eventually by two towers of office accommodation, the first of which is currently under construction.

The tower structure is of a unique form, incorporating major suspension elements and precast floors to provide column free space and unimpeded areas for entry at three separate podium levels which link the site with adjacent parks and the general sloping topography. Some aspects of the design approach in this building have been described in Refs 1 and 2. This paper will discuss the detailed design procedures and the construction planning.

Ref 1 - The Influence of a Wind-Tunnel Study on the Design for the Qantas Centre, Sydney, Australia by D Gilling, P O Miller and R E Whitbread - 1971 Wind Effects on Buildings and Structures, Tokyo.

Ref 2 - Model Analysis of the Qantas Centre, by P O Miller, Structural Models Conference, Sydney 1972.

The Bank of New Zealand: Concept and Design

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Unique in New Zealand, the new 30-storey Bank building in Wellington will be the tallest in the country and the first to express structure as the external appearance. Like the John Hancock building in Chicago, the B H P building in Melbourne, and others before it, the Bank of New Zealand has broken new ground in honesty of construction.

The paper, although presented early in the construction phase of the project and before practical bugs have been entirely eliminated, nevertheless describes up-to-date techniques of design and team development of a modern major tall building and this in an earthquake environment. Dynamic earthquake analysis, both elastic and non-elastic, are discussed and the effect of the practical interpretation of these into the completed building is described. Design is influenced by site conditions, materials handling and labour problems and emphasis is given to off-site fabrication and to simplicity of erection and fitting out. Cladding, glazing and partitioning are all included in the total earthquake design.

When completed, the new Bank building will form a nucleus at the hub of the New Zealand capital's downtown commercial centre and in its building create a new precedent for the use of structural steel in that country. A safer building which is competitive in cost and in end return for investment has resulted. Co-ordination and co-operation of all professional and building disciplines are a keynote in the paper.

Centrepoint Project, Sydney.

Alexander Wargon
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Consulting Structural Engineers, Sydney, NSW

The Centrepoint Project comprises complex retail-office block connecting major department stores via 3 overstreet pedestrian bridges and two underground tunnels. These means of access provide maximum separation of pedestrian and vehicular traffic.

The main feature of the Centrepoint Project is the 260 m tourist tower. The shaft of the tower comprises 6.70 m diameter slotted steel tube housing stairs, lifts and services. The 7 level turret, 28 m in diameter, is constructed of structural steel. The tower is guyed by 2 families of 28 cables which generate a single sheet hyperboloid of revolution. Each cable is pre-tensioned and anchored to the roof of the 15 storey concrete building.

The design of the tower required research into the wind climate of Sydney and this was followed by extensive testing of aeroelastic models at the Boundary Wind Tunnels at the University of Western Ontario, Canada, and Department of Civil Engineering, Sydney University.

The 150 m^3 service water tank suspended on 10 m long cables, was used as an auxiliary damping device.

A Rational Approach to Fire Resistant Design

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The purpose of the paper is to describe a rational approach to the design of Tall Buildings for fire, with particular emphasis on steel structures. The approach described is independent of existing regulations and requirements and is an attempt to show the potential of probabilistic and limit state concepts in the field of fire design. The first portion of the paper defines the limit states, ie the various failure modes likely to be encountered. The second part describes the ways in which these limit states can be satisfied. It is emphasised that many of the limit states are not associated with structural performance, although regulations and codes have in the past tended to emphasise this aspect beyond all others. Records of fire performance of recent tall buildings are shown to support this contention.

In satisfying the limit states, it is argued that there are often many different solutions to the single problem of ensuring adequate fire performance. Once again, current regulations tend to only permit one solution. The need is shown to be to clearly define the objectives of fire design and to allow engineering professionalism to operate in the achievement of the objectives. The US GSA proposal is described as one method by which rational fire design can be achieved.

Fire Safety Criteria for the Design of Tall Buildings

Duiliu Sfintesco
Director of Research, Centre Technique Industriel de la Construction Metallique, Puteaux, France

Preliminary remarks

- Philosophy of fire safety in Tall Buildings
- Fire hazards in Tall Buildings as shown by experience
- Objectives of fire safety in Tall Buildings

Fire safety criteria for the architectural design

- Criteria for internal distribution
- Compartmentation
- Egress routes and refuge areas
- Use of non combustible materials
- Architectural details

Fire safety criteria for the structural system and the non structural elements

- Stability of structural elements
- Structural design for fire safety
- Stability of non structural elements
- Repair and reusability after fire

Fire safety criteria for the service systems

- Vertical transportation
- HVAC
- Electrical systems

Special equipment for fire safety and fire fighting

- Detection, alarm and communication
- Automatic fire fighting
- Access for fire fighting teams
- Emergency power supply
- Water supply for fire fighting

Special requirements for certain types of occupancy (including fire safety during construction)

Final remarks

Structural Fire Precautions in the Soviet Union

Igor M Lyalin
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The report includes the information about regulations and methods which are used now in the Soviet Union for fire protection of structures and buildings.

It points out the urgency of the fire resistance problem for buildings and lists the initial determinations for the basic conceptions; then requirements of the Code for fire precautions of buildings and individual structures are given.

The degree of the fire resistance of buildings and structures is established by the special Code depending on the purpose of the building, the characteristics of the building materials and types of the structures.

The taller the building, the greater the fire danger and the more acute is the problem of the evacuation of people and extinguishing the fire. The regulations of the Code are more strict for tall buildings.

The value of the fire resistance of building structures may be determined in an experimental or in an analytical way. When experimental method is used for the determination of the value of fire resistance of structures, models are subjected to the fire test on the special mountings. It is more advantageous to determine the value of the fire resistance by the analytical method in cases when supposed real conditions of the structure differ greatly from the conditions at the standard fire resistance experiments. The modern methods of analysis make it possible to determine the actual and necessary values of the fire resistance of the structure as exactly as possible.

The fire protection is the complex of the organisational, constructional and technological measures; its main purpose is the prevention of fire, the restriction of fire spread and minimum damage at the successful extinguishing of the fire and evacuation of the people. To achieve this aim, preventive measures need to be worked out to use the rational architectural and lay-out solutions and modern equipment to extinguish the fire. The increase of the structural elements' fire resistance gives good results too.

In accordance with the above mentioned, the main constructional arrangements on the fire protection are considered in the report.

And finally the examples of the project and practical solutions are described.

The Role of Structural Consultants in the Design of Tall Buildings

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The structural designer of tall buildings requires to consider and solve many technical problems additional to those normally dealt with in low rise structures. These involve:

1. Proper assessment and selection of design loads.
2. In depth search of structural systems most suitable to the particular case.
3. Proper construction of a representative mathematical model to simulate the contemplated building structure.
4. Assessment of short and long term structural responses to the selected design loads. Dynamic as well as static analysis may be required.
5. In depth consideration of material behaviour under stress, particularly long term effects.

The rapid development of sophisticated, computer oriented, structural analysis methods now gives the designer the opportunity to obtain structural response information to almost any desired degree of detail. The writer believes that matching progress is needed in materials technology research and the gathering and statistical analysis of natural phenomena records.

Satisfaction of limiting structural response criteria under the selected design loads of tall structures often requires large sized structural elements, strongly influencing the architectural treatment of tall buildings.

In addition to the traditional tasks of considering load-response matters structural consultants have become increasingly aware of the vital role they must play at the design stage in minimising construction time. The relative financial success of a tall building venture is highly dependent upon early completion of the building. Since the structure of tall buildings always falls on the Critical Path Line, it is imperative that the structural consultants recognise and place appropriate priority to construction time as one of the design criteria parameters.

The professional building investors have shown concern at lengthening construction periods of tall buildings and have appointed professional project managers, building consultants and C.P.M. analysis to the design team in an attempt to stem the tide. Such appointments have been most beneficial in obtaining early realistic assessments of construction time needs. It works well for the purpose of critically reviewing early design proposals and reducing the number of critical sequential construction steps.

The initiation of novel structural solutions to benefit construction timings, nevertheless, likely to always remain the prerogative of the structural consultant.

Finally, the paper makes reference to the worsening industrial situation in the construction industry. The financial effects on major projects can be disastrous.

This problem is already being taken into consideration at the design stage, but a great deal more thought will be needed.

Design Criteria For Very Tall Buildings

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As building heights increase, the development of the structural system becomes increasingly dependent upon limitations imposed by the steady-state and the swaying motions imposed by wind loading. These limitations are required so as to protect both structural and non-structural components of the building system from excessive damage and from excessive maintenance costs. Of equal importance is the need to limit swaying motion to levels consistent with the psychophysiological characteristics of building occupants.

Aspects of design criteria most uniquely associated with the *tallness* of buildings can be found in those issues involving the stability of the overall structural system and of specific structural components. The need to consider $P\Delta$ phenomena and to ascertain the required strength and stiffness of column supports (ie connections) dominates this problem.

Structure deformations impose like deformations on rigidly connected non-structural elements. The ability to accept structure deformation — either through deliberately planned jointing systems or through elastic deformations — is an important characteristic of all such non-structural elements.

In both structural and non-structural elements, care must be taken in isolating the shearing component (column-girder bending) from the flexural component (column shortening and lengthening) of structure motion. The first because it produces a racking distortion of partitions and the like and the second because it tends to produce a vertical compression in the same elements.

Collins Place Project, Melbourne

John J Peyton
Partner, John Connell & Associates,
Consulting Engineers, Melbourne

An integrated building project comprising two towers 600′ high. One tower incorporates a 16 storey *atrium* design hotel at the top of the tower. The atrium is roofed with a space frame and acrylic domes and is 94 ft diameter x 175 ft high.

A base building containing retail shops, cinemas, medical suites and convention facilities, includes a unique space frame and acrylic dome covered air conditioned "Great Space" which is the hub of the complex. Five basements provide car parking on the $3^1/_2$ acre site.

The office towers are of hybrid construction incorporating the dual economies of R.C. vertical systems and steel beams in horizontal systems. The centre core is a R.C. wall system with clear span floors using steel beams (with sprayed fibreproofing) and cast insitu slabs of 5" L.W. concrete composite with the beams.

The precast structural facade has T shaped architecturally finished units 14 ft x 12 ft with hollow column and solid spandril. Columns incorporate a very light steel U.C. section for erection of floor system 3 floors ahead of the facade. Hollow columns act as forms for R C.

Sway strength is obtained from a tube in tube principal and a dynamic model study was done to study the induced affect of one tower on the closely situated other tower.

A vibration study was done on the high strength beams (grade 350) of the office floors. This study used a full size prototype segment from which a mathematical finite element model was developed to prove the total floor.

The 55 ft deep excavation in highly jointed silurian mudstone incorporates interesting solutions for support of the excavations. Support for adjoining buildings up to 22 stories tall involved substantial planning decisions in the new basements. Elaborate movement monitoring techniques were employed to provide control during excavation and construction.

B H P House, Melbourne

J R Fowler
Partner, Irwin Johnston & Partners Pty Ltd,
Consulting Engineers, Melbourne, Victoria

B H P House currently dominating the Melbourne skyline, is a unique tall building.

Unique because it brings together into one building many of the most recent technological advancements in architectural and engineering design and construction; presenting them clearly and forcefully in an expression of structural form which reflects the engineering character and strength of the client and his product — Steel.

B H P sought *through* the construction of this building to achieve a prestigeous national headquarters building, which, through its technical excellence and innovation, would demonstrate and extend the potential for use of steel in tall buildings.

This paper highlights the main features of the design concept. Commencing with the architectural planning, and detailing the design and fabrication of the composite steel plate skin to the building which acts as both weather protection and a major component of the building's structure.

The structure is a complex interaction system, which combines the structural characteristics of an external tube with those of an internal braced core through the action of multi-level cap trusses which mobilise the entire vertical framing in the resistance to wind forces; thus generating a highly efficient three-dimensional structure.

Other structural features described are:-

Long span composite castellated floor beams, composite columns, composite metal decking, fire spray, ultra-high strength bolting, together with extended use of A151 steel and Innershield welding.

B H P House has the first total energy system commissioned in an office building in Australia. All electrical, heating, and cooling sources are contained within the building and there is no connection to any external electrical supply. All power is derived from dual fuel engines operated primarily on natural gas, but using *distillate fuel* for generation under emergency conditions.
Advanced computer techniques were used by both the structural and the mechanical consultants for the design, and the design optimisation, of the structural and the heating/cooling systems.

Finally, the paper outlines the singularly important structural research and instrumentation program that has been funded by B H P with the intention of defining the characteristics of the loadings applied to tall buildings, and to establish the static and dynamic response of this building to these loadings.

August 1973

The Economics of Tall Buildings

George Clarke
Director of Planning

Ken McDonald
Architect and Urban Designer,
Urban Systems Corporation Pty Ltd

The paper will attempt:-

To identify the historic, cultural and economic determinants of the tallness of tall buildings.

To review the degree of relevance of past and present determinants in the light of our own speciality, ie. of urban planning, herein defined as the identification of a community's environmental needs and demands and attempts to self-consciously plan and control urban systems in the pursuit of those objectives.

To speculate on the relevance of tall buildings in possible future urban systems.

Historic, Cultural and Economic Determinants

The tallness of buildings tends to vary directly with the relevant degree of social, economic, and/or cultural agglomeration of activities in space. This is obviously true of Cathedral Cities and downtown Manhattan but less so of some Middle Eastern cities or of London or Geneva.

The tallest single structure in a community, whether pyramid, Cathedral fortress, town hall, private or government office tower, proclaims dominance by the particular ruler, priesthood, bureaucracy or institution for which the structure was built. Historically, tallness proclaims power. The use of power commands resources of men, money and technological skills to produce tallness.

The technological and managerial revolutions of recent centuries have produced modern megalopolises, the central business districts of which are the nerve centres of activity systems of increasing complexity and interdependence. Nineteenth and early twentieth century revolutions in metropolitan and regional horizontal transport made modern megalopolises, and their characteristic central business districts, possible.

The tall office building appears to have originated in the 1890's in Chicago, as that city achieved economic dominance over the American mid-west and west. New structural technologies and sophisticated vertical public transport systems together with the evolution of real estate as an investment mechanism, made it possible. It originated in the United States as a pragmatic application of economics and technology. It was taken up by European architects and their clients, often motivated by the aesthetic excitement of tallness as well as by its functional advantages.

Review of Past and Present Determinants

Tall buildings, clustered at points of maximum regional accessibility, have produced high efficiency in person-to-person contact, as well as prestige in the power of an organisation to locate at strategic locations. These factors have produced high returns from the development of sites which themselves rapidly appreciate in value. This cycle then attracts more investment in ever taller structures. The concentration of high buildings has been accelerated by increasing efficiencies of vertical public transport, declining effectiveness of all forms of horizontal public transport, and by the increasing barriers to pedestrian movement within city centres. It becomes quicker and more pleasant to move in elevators than to move a greater distance horizontally.

Recently, in Sydney and Melbourne the flow of investment by relative amateurs into tall office buildings, particularly in fringe locations, has produced an over-supply of badly-located tall buildings. Popular disgust with environmental degredation is now beginning to inhibit the uncontrolled location of tall buildings in urban areas.

Speculation on Relevance of Tall Buildings in the Future

Rather than attempt to predict or prescribe at this historical juncture, one can only speculate on their future which is bound up with the future of the city as a whole. The city can be seen as an enormous communication network in which information is becoming a more and more important component.

High rise buildings are an expression of need for face-to-face communication —they are a vehicle for close, organised exchange of information —they are an expression of the forms of *centralisation* in city growth.

However, improvements/advances in communications technology and transportation could supersede this need, thus having profound implications for future city form and function. These advances will potentially increase the forms of *decentralisation* in urban complexes — leading to the disposal of traditional CBD functions and consequently less demand for such intensive forms of land-use.

The forces of centralisation are leading towards the concentrated super-city with more and more intensive use of traditional urban cores expressed in higher and higher buildings. However, the forces of decentralisation will potentially lead towards a looser urban complex with more relatively independent and integrated sub-centres around which high rise buildings could crystallize without, however, the demand for such enormous scale witnessed so far.

The Environment Around Tall Buildings

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Environmental features are broadly classified into three categories: microclimatic, sociological and psychological.

Emphasis is placed on microclimatic features of the environment as more information and design criteria have been developed in this category. Topics discussed in this category include temperature, sun penetration, noise, wind, dust and pollution problems in urban environments. Correlation between physical measurements and corresponding responses by city occupants in a recent survey in Sydney, indicate that planning and building design criteria can be specified in terms of physical measurements. Other results of the survey indicate the differences in response to the environment related to age and type of activity of occupants. Dust and noise rate highly in all group responses. Methods of predicting such conditions are needed.

Sociological problems posed by tall buildings include the 9 am rush and 5 pm whistle syndrome, concentrations of similar age groups, restricted occupational activities, high crime rates in urban areas and the growing condemnation of high-rise apartment buildings, particularly where children are involved. There is an urgent need for broader, more co-ordinated, detailed surveys in these areas. Existing design information gained from such surveys is not as definitive as physical measurements of microclimate.

Similarly, the distillation of design guidelines from psychological studies results in even less definition. Visual and physical isolation from surrounding people, effects of enclosure from canyon-like streets to pokey liftcars, non-identity of *place* in repetitive tall buildings, vertigo and loss of human scale are some psychological aspects that deserve study.

Only a well balanced and co-ordinated study of all aspects of urban environments will provide the knowledge to help understand their great complexity and avoid the pitfalls of over simplification of the past.

Environment in Tall Buildings

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Along with the development of tall buildings has come the development of an increasingly sophisticated technology to meet the need for more precise control of the steady state internal environment in such buildings. This is a trend which we would logically expect to continue.

However, an analysis of the physiological and psychological requirements of the human organism suggests that a steady state environment may not be the most appropriate one in which to work and live. An extensive review of the literature from a number of fields indicates that current design standards (relating to the steady state internal environment) which are often derived from short-term or limiting condition human factors experiments may need re-examination.

This paper:

i) provides an evaluative review of this literature
ii) outlines the initial stages of a research programme aimed at examining these issues.

The Social Environment of Tall Buildings

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The area of concern is that of tall buildings as a residential environment. As such the residential environment is considered in relation to community standards and patterns of accommodation. It is viewed in terms of the general expectation of housing types within a particular society. In the case of the Australian experience expectations centre around the suburban way of life within a highly urban context. Traditional attitudes to neighbourhood and relationship are compared with the experience of dwellers within high rise housing complexes. Emphasis is placed on patterns of child rearing and on social contacts which have stemmed in the past from the availability of private exterior space as well as private interior space. It is suggested that access to privacy to this degree has resulted in a restrictive mode of discipline and in social relationship which are home centred. Consideration is also given to the effect of differing ethnic and socio-economic status particularly in relation to choice and decision making in the selection of housing and in ultimate satisfaction and adjustment. An attempt has been made to review the limited research studies into the effect of the high rise environment on human functioning in relation to specific groups, for example different types of residents, other residents in the locality and members of the wider community. Some case histories have been included for illustration in an effort to fill in some of the gaps.

The M L C Centre, Sydney

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An 800 ft. high reinforced concrete tower will be erected at the corner of Castlereagh Street and Martin Place. The lateral resisting structural system is a tube in tube. The service core is the inner tube where, the outer tube consists of 8 columns arrangement spaced at 60' and 35' alternatively and connected with 6' deep I-beam section. Because the lateral deflection for the tower is so much less than the accepted limit the only criterion for design is the strength of the members. The structural principles used are basic shear wall frame interaction.

Secondary effects such as thermal movement, creep and shrinkage and thermal cracking have been fully investigated.

A great emphasis has been placed on concrete technology given the relatively large size of the members.

The total economy of the building has been investigated, and the proposed tower with large spans proved less expensive than a tower where the outer tube has closely spaced columns.

All construction problems which resulted from the unconventional nature of the structure have been investigated and successfully resolved.

A model study and a 3-dimensional analysis of the tower fully confirmed the feasibility of the structure.

Park Towers, Melbourne
30 Storey Apartment Building

David C Taylor
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Consulting Engineers, Melbourne, Vic.

Park Towers is thought to be the tallest building so far constructed using the bearing wall principle, thereby dispensing with a conventional frame. The building is entirely precast using panel wall and floor elements of lightweight aggregate concrete.

Built by the Housing Commission, Victoria, the building has been previously described in some detail (1). In this paper, important structural design aspects are discussed, particularly the measures taken to ensure stability of the assembled mass of prefabricated elements under normal and abnormal loading (eg Seismic) or premature failure of one or more panels or connections.

In pursuit of the aforementioned aim and to maximise the stiffness of the structure, all in plane walls separated by door openings have been coupled together by door head beams acting compositely with the floor slab. Furthermore, to ensure monolithic action, a judicious *bonding* of floor slabs relative to wall joints has been adopted as well as a moderate level of vertical post-tensioning applied through selected walls. Expansion joints have also been avoided, thus utilising fully the inherent strength available in the total assembly. These aspects are discussed in the paper.

Thermal effects on such a large building are of great importance and much consideration was given to the adoption of non-insulated exterior bearing walls subjected to high temperature variations arising from direct solar heating. The paper describes this effect as well as observed deformations in the horizontal plane due to ambient heating effects. The latter were found to be somewhat different from that expected and an explanation is given.

To create open space at ground floor level, many of the bearing walls are supported at first floor level by large two leg portal frames, the beams of which are post-tensioned in stages to provide a uniform upward pressure on the supported wall. This concept is also discussed.

Throughout construction, strain measurements were made to arrive at the stress distribution in several of the walls at the lowest level. The results of this investigation are summarised and an indication of the contributions made by non bearing concrete partitions is given.

Finally, the paper describes several points of interest including the problem of securing the tower crane to the building.

Limit State Philosophy and Application

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University of Melbourne, Victoria

The general concepts of the limit state design method are reviewed and the reasons put forward to support its adoption are examined.

The degree of acceptance in the main industrialized countries and in the different structural material mediums is reviewed. The work of international committees in attempting to achieve uniformity in notation and consistency in values is beginning to produce results and trends of thought and action are described.

Some of the real and imagined practical difficulties seen by designers are reviewed and the need for collaboration between code writers is emphasized if the full benefits are to be obtained. Means for achieving progress without drastically upsetting accepted standards are described and the advantages and disadvantages of such means are examined.

Progress towards a fully probabilistic design method can best be made through the limit state format but this is still rather far removed from practical possibilities. The general trends and present status are reviewed and probable directions of future developments are discussed.

Superimposed Loads

John Nutt
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Consulting Engineers, Sydney NSW

Tall buildings concentrate their loads onto a small number of vertical members which impose high forces over a minimum area of ground. The magnitude and effect of superimposed gravity loads on such buildings are reflected in costs and planning restraints to a greater degree than in any other type of building forms.

There is no phase of the design process which has recevied so little critical attention as the magnitude of such superimposed loads. As if in need of mutual reassurance, building codes throughout the world are based on each other. The number of surveys which have obtained quantitive statistical information is distressingly small. The major codes are based on such surveys as were undertaken 30 years ago when the style of building and occupancy differed from that of today. Partly because of the lack of reliable basic information and partly because of the legal status given to building codes which has made changes difficult, designers have accepted without comment the loads set down.

The advent of the concept of probability in the design process demands that actual loads applied to a building structure, together with the frequency of such loading, rather than an estimate of the so called *minimum design loads*, be known for different types of occupancy. After years of neglect as a topic of research, several major surveys have been carried out in overseas countries. These will form the basis of the next generation of Building Codes loadings. There is real need for such information to be available for Australia.

The Economics of Tall Buildings

Colin F Moore
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Introduction The case is put forward, not only as a firm belief, but also in anticipation of controversy during conference proceedings, that tall buildings are not only justified and necessary, but also advantageous, environmentally, sociologically, and not the least important, as marketable products.

Past Limited engineering skills and utilisation of steel etc were not the only historical restraints to the development of tall buildings. Pyramids 500 feet high were built 5000 years ago. Adequate land and market recognition, need and acceptance (no doubt using different terminology) were more likely causes.

Present It is suggested that the era of tall buildings is still in its formative period. Population growth and concentration, aided and abetted by increasing tenant demands for prestigeous accommodation will reinforce many of the following advantages.

Facilitation of people movement and multiplicity of activity.

Street and footpath widening, setbacks, etc. with resultant reduction in congestion.

Creation of plaza areas, thus simulating old style meeting places.

Environment of breathing space and sunshine.

Complete natural light exposure for tenants.

Associated service and retail activities under one roof in all weather.

Multi-level links with other tall buildings, improving circulation.

Architectural impact.

Best utilisation of land — increasingly in short supply.

Future Present trends indicate that our successors will live and work in the vertical rather than the horizontal plane. Marketing, commercial and planning considerations point to the necessity for cities of the future to be predominantly integrated high-rise buildings, linked for circulation, with large open areas at ground level.

Conclusion It is the responsibility of the present generation to ensure that, within appropriate parameters, the creation of these objectives becomes policy in order that the future community inheritance be infinitely better than the present.