

Inside the Square Box

Skyscrapers and techno-economic developments in Melbourne Central Business District (1955-1995)

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To my parents

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Summary

This thesis argues that in Melbourne, in the second half of the twentieth century, skyscrapers followed a techno-economic development of genesis, expansion, oversupply and crisis that was similar to the Schumpeterian process of creative destruction, and the form of tall office buildings in the city coalesced into a typological model, the square plan tower, as a response to increasing entrepreneurial activity of speculative purpose, converging interests of public and private stakeholders, and the clustering of strategic innovations in construction technology.

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Preliminaries

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Abstract

Focusing on the Central Business District of Melbourne between 1955 and 1995, this thesis investigates the evolutionary dynamics of tall office buildings. The investigation is undertaken from a techno-economic perspective that is informed by the testing of four factors of influence in relation to 1) function, 2) public and private stakeholders, 3) architectural form, and 4) building materials and systems.

Following an evolutionary path similar to the Schumpeterian process of creative destruction, a building type, consisting of an office tower with square footprints, dominated the production of skyscrapers in Melbourne. After an embryonic stage of genesis, the type evolved in response to public and private needs of prestige and, during times of technological and economic uncertainty, as the materialisation of a quest for integrated efficiency in design. The type then entered a stage of crisis in concomitance with cultural changes in urban planning, a moment of cumulative synthesis in technological innovation, and oversupply of floor space due to increasing speculative activity. This dynamic process of typological evolution was matched by the long wave of a business cycle that began after World War II and terminated with a major economic downturn in the early 1990s.

The formal evolution of the dominant building type is discussed with a focus on spatial qualities that are critical for the techno-economic feasibility of office planning. A dataset of buildings in Melbourne CBD provides the empirical evidence that explains the dynamics of transformation of the dominant type and of other, less dominant but not less relevant, tall office building types that were used in the city in the second half of the twentieth century. Technological events of international relevance that developed between Australia and the United States of America in the same period are discussed, and American inputs are identified as a primary influence on the development of skyscrapers in Melbourne.

Inferring from the empirical evidence of this retrospective, this study suggests that with a techno-economic investigation centred on four concomitant and interrelated factors of influence, the architectural form of tall buildings can be understood as a critical nexus of large urban transformations and strategic innovations in construction technology.

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Declaration

This is to certify that:

- i. the thesis comprises only my original work towards the PhD except where indicated in the Preface,
- ii. due acknowledgement has been made in the text to all other material used,
- iii. the thesis is fewer than 100,000 words in length, exclusive of tables, maps, bibliographies and appendices.

Signed

Giorgio Marfella, 8 February 2017

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Preface

The idea of this thesis originates in 2006, when, supported by the prospect of supervision of Professor Paolo Tombesi, I joined the University of Melbourne as a part-time post-graduate student in the Master of Architecture by Research. The initial research proposal sought to compare business culture in architectural practice in Italy and Australia. My part-time engagement as a research student was motivated by the wish of keeping an intellectual engagement with architecture, while I persevered - in parallel – in a full-time career with large architectural firms in Melbourne.

The initial research plan was set with ambitious challenges of logistics, financial support and research ethics. But challenges turned into unsurmountable obstacles once I discovered that large Australian firms had scarce interest to reveal working attitudes on key projects of recent completion. I then opted to redesign the object of the research, and, thereon, interests shifted from the processes of organization within firms to the physical effects of the interactions between business and architecture. In these circumstances, one episode took my attention to Melbourne's skyscrapers.

In 2007, while employed in a large corporate firm, I was assigned to join the early stages of a mixed-use supertall building project in the city of Melbourne. Challenged by the need to match a large office floor plate in the lower floors with another two functions above, the design seemed to have reached a dead-end until one simple and obvious option emerged: a scheme based on two centre-core square towers joined side by side, which, being forty by forty metres wide each, gave approximately 2,400 square metres of net lettable area. This embryonic sketch, albeit clearly feasible, was described by a lead designer as an accidental stumping into an obsolete type that re-emerged from the past, and, as a consequence, it was discarded in favour of another less-geometrically restrained scheme.

While working on the same project, I was engaged in the task to gather information on the tallest buildings of the city. During the exercise, I began to collect typical floor plans of skyscrapers in Melbourne and other Australian cities. Going far beyond the requests of the initial task at work, I continued to collect more plans and building data on my own, once I observed that many tall office buildings in Melbourne presented a remarkable phenomenon of formal invariance. The majority of skyscrapers in the city

seemed to respond to one pervasive typological model: square plans with centre core – a model similar to a well-known precedent, the former World Trade Center in New York. In Melbourne, these buildings were certainly smaller than the Twin Towers, but were somehow homogeneous for dimensions and footprint, being not far from an ideal tower that measured forty by forty metres in plan.

Fascinated by this observation, I proposed to redesign the thesis with the scope to explain this phenomenon of built form. The proposal was accepted by Professor Tombesi, who at that point – given the necessity of a retrospective study – invited Professor Philip Goad to join as a co-supervisor. It was under these circumstances, that in 2008 my enrolment in the Master by Research was converted into a part-time candidature for the degree of Doctor of Philosophy.

The scope of the research has changed largely from the original intent of the comparative study between Italy and Australia, but some elements of continuity with the origins remain. This thesis seeks to explain the dynamics of a process, which seems to contest the idea that in contemporary practice successful social and commercial outcomes can rarely coexist with simple formal outcomes. The idea that this erosion was a matter of relevance was inspired by witnessing first-hand a progressive shift in architectural practice towards what Kenneth Frampton described as the “technological sublime”, which – as I could witness at work in Australia – was driving contemporary architecture into a pervasive “domination of the spectacular”.¹

The suspicion that this shift was in place was reinforced once I read Thomas Spector’s moral provocation about the unattended potentials of “Modernist Minimalism” in *Harvard Design Magazine*.² I was surprised to see how Spector’s remarks matched closely with the attitude of many colleagues in lead design roles, who seemed rather disenchanted with morals of efficiency and rationality in making design proposals. This shifting of priorities, as I saw it, was not excluding commercial projects where economics, simplicity of form and efficiency could have been easily justified. I also

¹ Kenneth Frampton, “Technoscience and Environmental Culture: a Provisional Critique,” *Journal of Architectural Education* 54, no. 3 (February 2001): 123.

² Thomas Spector, “The Morals of Modernist Minimalism: a Provocation,” *Harvard Design Magazine* 25 (Fall/Winter 2006).

noted that some trends in corporate practice seemed to have been detached from any antecedent feeling of continuity with the modernist tradition.

In order to verify these assumptions, however, I understood that the research could easily derail into a subjective manifesto. I was then helped by Professor Tombesi in realising that, if I chose to operate retrospectively along the lines of what Manfredo Tafuri defined as “operative criticism” this *ethos* could still be warranted to coexist with scientific rigour. While I intended to set the foundations of an operational critique of the present, a retrospective on a phenomenon of formal invariance seemed pertinent within Tafuri’s operative *dicta*, which command to profess selectively but also to follow an impartial and anti-apocalyptic investigation strictly based on the analysis of facts of built form.³ This study is operative in the sense that holds also – albeit in a manner that is left silent in its content – a message for the present. But the element of persuasion, rather than being founded on present phenomena still *in fieri*, is voiced with the presentation of historical facts from the past.

One aim of the criticism is to prevent that, among architects and other stakeholders of the built environment, a cultural approach may prevail, according to which formal homogeneity and ubiquity should be seen as a curse and a collateral damage of an arrogant technocratic past (which by extension would be an anachronistic *ethos* for the present). This reading may be justified in some cases, but, in relation to a large family of ageing tall buildings of the second half of the twentieth century, this approach is problematic for two reasons.

Firstly, this reading today may prevent to understand in full – because distorted by generic formalist assumptions - the reasons of some major architectural outcomes of the past. Secondly, the rhetoric, which may condemn through form alone past architectural models, could end up endorsing- albeit inadvertently – the same destructive mechanisms of the past that condemns. In this sense, the purpose of the retrospective is to unearth a new ground where questions for the present of the built environment can be formulated for new research paths and free of pejorative assumptions. At the same

³ Manfredo Tafuri, *Teorie e storia dell’architettura* (Bari: Laterza 1968), 186-192.

time, the operative intent should not be mistaken as an anachronistic endorsement of formal solutions from the past. The aim is not to catapult into the present a stylistic recovery of some historical models. The aim is to capitalise on the cultural significance of skyscrapers to explain some processes of modifications that, irrelevant of the formal vagaries of times, may be essential, intrinsic and perhaps inevitable for the architecture of cities and of their commercial landmarks.

Since 2008, work on this thesis had to stop several times due to personal circumstances. Research activity proceeded with a hit and miss pace until 2014, when, helped by a career change from architectural practice to full-time academic life, I was finally able to settle with more continuity and consistency into this study. The relevance of the initial enquiry did not diminish and it was reinforced by events that in the meanwhile occurred globally and in Australia. The aftermath of the Global Financial Crisis on the one hand, and the resurgence of tall building activity in Melbourne on the other hand, have amplified the urgency to explain the mechanics of change induced by the interaction of business and architecture.

Moreover, during the research, the initial interests on architectural form, which I observed *prima facie* in the square plan towers of Melbourne, led to further observations and new interests. Progressively, the spectrum of motivations that sparked the initial research questions enlarged. To the initial queries about formalism, new ones - perhaps more timeless and universal - emerged, particularly in relation to the cyclical interactions of technology and economics, and how these two realms of human activity can work hand in hand with the processes of innovation in design and construction.

Giorgio Marfella

Melbourne, 27 January 2017

Acknowledgements

There are many academics, industry colleagues, research participants, public servants, friends and relatives who gave me help, support and stimulus in the making of this thesis.

The first acknowledgements are owed to the supervisors, Professor Paolo Tombesi and Professor Philip Goad. I feel privileged to have been supervised by their outstanding knowledge, experience and reputation. For the topic and approach of this thesis, I could not have expected to be followed by academics with a higher level of sophistication and authority. Paolo, first of all, gave me trust and confidence from the very beginning; he was generous and friendly well beyond the customary expectations implicit with the role of supervision. He was also patient and tolerant whilst this project proceeded at a much slower pace than we both expected. His remarks along the way, however, were always timely, penetrating, challenging, demanding, unforgiving and, therefore, of great use. Paolo's methodological rigour and capacity to find weak links in the chain of reasoning was complemented by Philip's meticulous comments and suggestions on style, form and content. Philip brought to my attention many significant events and details about tall buildings and their designers, in Australia and in America. For someone like me - educated as an architect with a Euro-centric bias on architectural history in Italy, at the University of Florence - his support was indispensable, and his suggestions were always impeccable, precise and essential. Paolo and Philip gave me the confidence to traverse a topic of Australian architectural history, which is, in many respects, still largely uncharted.

Among the colleagues in practice, there are architects and interior designers with whom I worked, between 2006 and 2012, in four large Melbourne-based companies of architecture. In chronological order of employment, while this research carried on, I worked full-time at Hayball Leonard Stent, Bates Smart, Denton Corker Marshall, and John Wardle Architects. The colleagues who helped and inspired me are numerous. Roger Poole, chairman of Bates Smart, and Barrie Marshall, founder and chief designer at Denton Corker Marshall, stand out as inspiring figures; I was fortunate to meet them and work under their direct leadership on some tall building projects. My professional duties in practice were neatly separated from the activity of this thesis. Often, these

duties were more an impediment than a benefit for the research. For the greater part of the research, as a part-time PhD candidate, I had to study after hours, on leave periods or during week-ends. Yet, by working in these offices, I was blessed by the gaining of an insider's perspective on problems of commercial and tall building architecture. In practice, I also established contacts and familiarity with the local building industry. On several occasions, especially during data collection, my practical experience was priceless and gave me discernment and orientation about background knowledge and many practical issues.

I am grateful, in general, to be part of the Council on Tall Buildings and Urban Habitat (CTBUH), and to Dario Trabucco of the Istituto Universitario di Architettura di Venezia, in particular, who, as the Research Manager of the Council, has invited me, in 2014, to join the CTBUH International Expert Peer Review Panel and the Academic and Research Group. As a member engaged internationally, I was able to access several resources on tall buildings, participate to two international conferences and contribute with papers that – albeit dealing with a different period of time – stemmed, to a certain extent, from the work done in this thesis. While working on a retrospective study, the network of the CTBUH was instrumental to keep an updated perspective on state of the art developments, events, publications and research activities on tall buildings worldwide. These updates include access to the most recent work of two contemporary American scholars, Carol Willis and Thomas Leslie, who have been an indispensable source of reference and inspiration for this study.

I have to thank several academics at the Faculty of Architecture, Building and Planning at the University of Melbourne. Since 2012, the Faculty has welcomed and encouraged me in a career change from architectural practice to full-time academic life. This support from academic colleagues gave me considerable help to persevere with the best motivation in this research. For this, I have to acknowledge the endorsement I received from the Deputy Deans of the Faculty from 2012 to 2016; first from Professor Paul Walker and then from Associate Professor Andrew Hutson. Another mention of gratitude is owed to Blair Gardiner, who besides offering me valuable teaching and research opportunities, has supported me as a mentor with hints about research,

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Facing the inevitable ups and downs of this long project, I found mutual support through the friendship with colleagues who, like me, are or have been employed as early career academics of the University of Melbourne. Among these friends there are above all Marianna Nigra, Alberto Pugnale, Mirjana Ristic Andrew Martel, Paulo Vaz-Serra, Dhara Patel and Hannah Robertson. Occasionally but always with sympathy and courtesy, I was supported by colleagues of the professional staff, above all Sally Jones and Jane Trewin of the Research Office, who understood the challenges and demands posed by my dual role of academic and student.

Between 2013 and 2016, as the subject coordinator of Applied Construction and Advanced Construction Technology, I invited at the Melbourne School of Design several guest lecturers. Peter Smithson and Simon Barnes from BGE Façade Engineering, Eben Simmons from Umow Lai, Andrew Raftopoulos from Bates Smart, John Bahoric from Bonacci, Greg Crone from Crone Partners, Phil Gardiner from Inwinconsult, Seifu Bekele from Global Wind Technologies, John Biondo from Boral Concrete, Fiona Aldous from Wiss Janney Elstner and Richard Drzewucki from Façade Engineering shared ideas and specialist expertise on tall building technology. As a consequence of their knowledge sharing, I was enriched and reinforced in the understanding of many necessary technical aspects that ought to be grasped for this study.

I must thank also many architects, friends and sessional colleagues of the University who, while working as tutors in my subjects, shared information about city projects –

old and new - and showed genuine interest, care and friendly curiosity about my progress in this research; my gratitude goes to Yohan Abhayaratne, Anthony Blazquez, Matt Borg, Tam Dao, Gosha Haley, Mohd Hussin, Paul Jones, Mark Lam, Carlos Lara, Michael Ledingham, Leigh Maizels, Jamie McCutcheon, Chris Membrey, Roberto Merlo, Ben Sheridan and Julian Tuckett.

I am in great debit with Steven Richardson, a long-standing master builder and superb construction manager. While teaching together a module on construction technology, Steve shared passionately his know-how on high-rise construction and first-hand information on the construction of city landmarks made by the Grollo Group, such as 120 Collins Street, ANZ World Headquarters, 101 Collins Street and Rialto Towers. My thanks go to Kevin Masci, ex-colleague of Bates Smart and former employee of Perrott Lyon Mathieson, for sharing a rare and highly informative monographic issue of *Building Product News* on Rialto, and plenty of gratitude is owed to Adrian Corsello, a friend and a long-term experienced project manager, who kindly offered insight, contacts and information on the development of self-climbing formwork in Melbourne.

An acknowledgment is owed to Aisha Dow, the city reporter of *The Age*; firstly, for calling me several times to participate in the media on current debates about tall buildings in Melbourne; secondly, for sending me a 1980s picture of the Rialto Towers taken directly from the digitized historical archives of the newspaper.

I am in debit with Yvonne von Hartel, Richard Foster, Ric Bonaldi, Daryl Jackson, John Davidson and Bill Melbourne who accepted to participate with open interviews in this research. They were a precious source of evidence and shared untapped information that is surely of great value for all scholars interested in Australian architecture. Their interviews allowed me to penetrate deeply in the retrospective dimension of this study. All participants shared time with generosity about many projects, trends and episodes that entered significantly their careers, which span, in most cases, more than 50 years of outstanding practice. The interviews were instrumental to verify information that was still hidden or trapped inside anecdotal evidence, and these contributions induced me to revisit and fine-tune some of the initial premises of the investigation.

The rich collection of books and periodicals of the Architecture Library at the University of Melbourne was a paramount and reliable source for thorough international bibliographical reference and for the retrieval of historical information from Australian and American periodicals. The staff of the Library, under the direction of Sarah Charing, was always friendly; Sarah allowed me, for the considerable period of two months, direct access to the dusty stack rooms of the collection. I was lucky to be conceded a relaxation of the procedures required for accessing the stacks and, thanks to the colleagues of the Library, I was able to help myself in the retrieval of hundreds of issues and thousands of articles in Australian and American journals. I was assisted as a patron by several staff members of the State Library of Victoria. There, I must thank in particular Des Cowley, Gerard Hayes and their colleagues of the Picture Collection; these librarians have painstakingly retrieved from an off-site shed in Ballarat hundreds of drawings in large format and a considerable number of voluminous files from the Stephenson and Turner archives. At the Public Record Office of Victoria, in West Melbourne, I ordered and retrieved dozens of large volumes of meeting minutes, rate cards, project drawings and files from the historical archives of the City of Melbourne. There, I was always served with courtesy, impeccable timing and careful assistance.

Ros Rymer of the City of Melbourne was very kind to meet with me and share some rare urban design guidelines of the 1980s. Likewise, Christabel McCarthy, a statistician of the City of Melbourne, met with me in person, handed me free of charge statistic data and facilitated access and reproduction of a number of historic surveys of the central City that are not easily available.

In late 2015, while I visited the United States for another research project, I was welcomed with great hospitality by Barbara Floyd, the director of the Canaday Centre of the University of Toledo, Ohio, and her husband Bill. Barbara, and her colleague Tamara Jones, have assisted and guided me through the voluminous Glass at Work files of the Libbey-Owens-Ford Glass Company Archives. While I gathered information for a different scope, the LOF archives opened a window on first-hand collateral evidence about American buildings that was important for this research too. In Toledo, I was also

fortunate to meet and learn about Chicago and American architecture with Katerina Ruedy Ray.

I wish to make a special mention about my parents, to whom this work is dedicated. Their help was critical in this long-term, ambitious and self-supported higher research degree. My mother and father in Italy have supported me *a fondo perduto* about anything to do with study in my life. This PhD was no exception. Alongside my closest relatives, they were vital especially towards the end of the thesis, when they gave me shelter and comfort during two winter writing retreats at home in Sardinia. Finally, I wish to acknowledge my wife Luanne and our two young children Jordi and Livia. Too many times I had to miss family time for yet another visit to archives, libraries, travel overseas or time spent self-absorbed writing at the home desk. Luanne, Jordi and Livia: if you will ever get a chance to read these pages, I thank you for giving me your unconditional trust and understanding that this task, one day, would be finished.

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- 10 (Electrolytic Zinc Building): Photographer unknown from *Architecture and Arts*, September 1959 (left); State Library of Victoria, Stephenson and Turner Archives (right);
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- 25 (Reserve Bank): Wolfgang Sievers, 1973, State Library of Victoria (left); Carr Design, www.realcommercial.com.au (right);
- 27 (Aviation House): Wolfgang Sievers, 1966, State Library of Victoria (left); *Constructional Review*, July 1966 (right);
- 28 (ACI House): Marc Strizic, 1968 (left) from *Architecture in Australia*, November 1968 (right);
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67 (Shell Headquarters): Giorgio Marfella, 2016 (left); *Constructional Review*, November 1989 (right);

68 (Bourke Place): Giorgio Marfella, 2015 (left); www.bourkeplace.com, 2007 (right);

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List of abbreviations

AAP: Aesthetics Advisory Panel, City of Melbourne
ACI: Australian Consolidated Industries Limited
AIRAH: Australian Institute of Refrigeration, Air Conditioning and Heating
AMP: Australian Mutual Provident Society
ANZ: Australia and New Zealand Banking Group
ATO: Australian Taxation Office
ASX: Australian Stock Exchange
AWG: Australian Window Glass Company (subsidiary of ACI)
BBR: Birkenmaier Brandestini Robin
BHP: Broken Hill Proprietary Limited
BLF: Builders Labourers Federation
BOMA: Building Owners and Managers Association
BSM: Bates, Smart & McCutcheon
CAC: Commonwealth Aircraft Corporation
CBA: Central Business Area – referred to early Melbourne planning schemes
CBA: Commonwealth Bank of Australia
CBD: Central Business District
CLUE: Census of Land and Use and Employment, City of Melbourne
CML: Colonial Mutual Life Assurance Society
CPI: Consumer Price Index
CRA: Conzinc Riotinto Australia
CSB: Commonwealth Savings Bank
CSIRO: Commonwealth Scientific and Industrial Research Organisation
CSR: Colonial Sugar Refining Company
CTBUH: Council on Tall Buildings and Urban Habitat
DATF: Development Approvals Task Force
DCM: Denton Corker Marshall
GDP: Gross Domestic Product
GFA: Gross Floor Area

HC Sleigh: Harold Crofton Sleigh Shipping Company

HR: High Rise [lift group]

IBM: International Business Machines Corporation

ICI or ICIANZ: Imperial Chemical Industries of Australia and New Zealand

IDO: Interim Development Order

LOF: Libbey-Owens-Ford Glass Company

LR: Low Rise [lift group]

MCC: Melbourne City Council

MMFB: Melbourne Metropolitan Fire Brigade

MLC: Mutual Life and Citizens Assurance Company

MMBW: Melbourne Metropolitan Board of Works

MR: Medium Rise [lift group]

MURLA: Melbourne Underground Railway Loop Authority

n. a.: record not available

NBA: National Bank of Australia

NLA: Net Lettable Area

OCAL: Overseas Corporation Aluminium

PLM: Perrott Lyon and Mathieson

PPG: Pittsburgh Plate Glass Company

PROV: Public Record Office of Victoria

PSALI: Permanent Supplementary Artificial Lighting of Interiors

RACV: Royal Automobile Club of Victoria

RAIA: Royal Australian Institute of Architects

RBA: Reserve Bank of Australia

RCA: Radio Corporation of America

r. n. f.: record not found

RVIA: Royal Victorian Institute of Architects

SEC: State Electricity Commission of Victoria

SFIT: Superannuation Fund Investment Trust

SLV: State Library of Victoria

SOM: Skidmore Owings Merrill

SR: Sky Rise [lift group]

List of abbreviations

UBR: Uniform Building Regulations, Victoria

USA: United States of America

VAV: Variable Air Volume

VBR: Victorian Building Regulations

VSL: Vorspann System Losinger

WWII: World War II

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Thesis

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Introduction

The socio-aesthetic appraisal of the tall buildings of the second part of the twentieth century is charged with problematic stances and trapped inside a paradox. On the one hand, tall buildings are a vehicle of powerful symbolic values, and the office tower, as the archetypical skyscraper of the twentieth century, was the tall building type that attracted the largest interest from critics and the general public. On the other hand, office buildings, because constrained by economic and technological imperatives, may appear at first sight as a phenomenon of mediocre ubiquity with predictable formal outcomes. The latter aspect is in evident conflict with the *dicta* of contemporary architectural formalism and of those who see architecture – in its highest expression – as a form of art perpetually tied to the obligation of symbolising the present. Under these points of view, architectural quality should be preferably synonymous of atypical locality, *ad hoc* performance, and spectacular complexity rather than pervasive globalism and predictable simplicity. Broadly speaking, the tall office building of the second part of the twentieth century seems to have rarely responded to formal principles of constant revolution and originality, and to have followed, for the most part, a path of relentless iteration and careless sensitivity towards the regional contexts where such buildings were located.

This paradox is present in the evolution of the historiography of modern architecture in the twentieth century and carries on in the twenty-first century. The trajectory of criticism that brought to an impasse in relation to the architecture of tall office buildings is outlined in Chapter 1 through the positions, among others, of Sullivan, Root, Pevsner, Giedion, Condit, Boyd, Banham, Jencks, Koolhaas and Huxtable. The debate on the cultural significance of some tall buildings of the post-World War II period has resurfaced after the destruction of the World Trade Center in New York in 2001, and the question of the architectural quality of buildings like the Twin Towers was a matter of

controversy that lingered on even ten years after 9/11.¹ In 2011, American architectural critic Paul Goldberger gave this response to the issue of the legacy of the Twin Towers:

(...) with a decade having passed since 9/11, it is important [...] to remember that the towers represented a kind of simplistic, arrogant urban design at its worst. They were abstract objects, as indifferent to the city at their base as to the skyline into which they intruded. These were not pleasant buildings to be in, and unless you happened to see them from far away at just the moment that the rising or setting sun was glimmering on their metal façades, they were not pleasant to look at. (...) We are trying to heal the city, and to learn from the mistakes of the 1960s.²

This line of debate is not limited to the specifics of New York and similar instances on the architectural legacy of the modernist skyscrapers have surfaced at the annual conferences of the Council on Tall Buildings and Urban Habitat (CTBUH). In 2014, for example, Antony Wood, the executive director of the Council, called for the rise of a “new high-rise vernacular” as a way to exhort architects, developers and engineers to “rethink” the skyscraper of the twentieth century in view of the ecological challenges of the twenty-first century. This position was introduced with pictures of skylines of three cities in different continents: Melbourne, Miami and Warsaw. The three cities were juxtaposed by Wood as examples of “aesthetically homogenized” skylines, which arguably belong more to the twentieth rather than to the twenty-first century. Melbourne, in this context, was represented as the Oceanian antithesis of the ideal skyscraper city of the “ecological age”.³ The observation seems pertinent from afar, but is Melbourne’s skyline truly aesthetically homogeneous? And assuming that this is the case, why?

Notwithstanding the good intentions implicit in the call for reconsidering architectural trends of the past in view of the ecological problems of the present, in Melbourne and in other cities of the world, there is a risk, that by lack of a full and unbiased understanding of their historical contexts, some buildings may be quickly dismissed as insignificant due to their predictable and allegedly simplistic and ubiquitous formal outcomes. But beyond the contingent need to safeguard some artefacts, which may be overdue for

¹ Paul Goldberger and Timothy Johnson. “Debating Tall: Are the Twin Towers Missed?” CTBUH Journal, (2011, 3): 5.

² Goldberger, 5.

³ Antony Wood, “Rethinking the Skyscraper in the Ecological Age: Design Principles for a New High-Rise Vernacular,” in *Future Cities: Towards Sustainable Vertical Urbanisms*, proceedings of the CTBUH 2014 Shanghai Conference, China, 16-19 September 2014, 26-38.

consideration with statements of heritage significance, there is an even greater risk. The risk is that the processes of modification that operate around tall buildings may continue to be read in prevalence from socio-aesthetic assumptions, leaving out the essential problem to explain this typology from a techno-economic perspective. These two points of view are not necessarily incompatible; a socio-aesthetic or ecological agenda that pursues to impact the cities of today and of tomorrow could hardly work from hypotheses made regardless of techno-economic explanations.

The architecture of tall buildings is a powerful indicator of the techno-economic processes that change the architecture of cities at large. Skyscrapers intersect a broad range of interests, from the several stakeholders who are involved in their conception, design, approval, construction and use, to the general public. For this and other reasons, historical studies on Australian tall buildings are not absent, nor are studies on the development of Central Business Districts in Australia in general,⁴ and of Melbourne in particular.⁵ The Australian literature on the architecture of tall buildings and central business districts has some notable gaps, however, at least from two points of view.

Firstly, studies on the historical development of Australian skyscrapers are fragmented and have rarely crossed the chronological barrier of the transition from modernism to postmodernism. The most comprehensive work to date on Australian modern high-rise is Jennifer Taylor's *Tall Buildings*, which chronologically is framed between 1945 and the early 1970s.⁶ Within the scope to cover a nationwide scale, the thorough case studies on buildings prepared by several contributors touched only on some city landmarks across Australia, and among these only two buildings were selected for Melbourne.⁷ Some essential information on major tall buildings developments in Melbourne after World War II has been covered by Philip Goad, Julie Willis and other contributors, but in the context of encyclopaedic coverage,⁸ or in monographic studies

⁴ Leonie Sandercock, *Cities for Sale* (Melbourne: Melbourne University Press 1975); Susan Marsden, *Urban Heritage: the Rise and Postwar Development of Australia's Capital City Centres* (Canberra: Australian Council of National Trusts and Australian Heritage Commission, 2000).

⁵ Miles Lewis, *Melbourne: the City's History and Development* (Melbourne: City of Melbourne, 1995).

⁶ Jennifer Taylor [ed.], *Tall Buildings: Australian Business Going Up: 1945-1970* (Sydney: Craftsman House, 2001).

⁷ Philip Goad, "ICI House, Melbourne" and "BHP House, Melbourne" in Taylor, 174-189 and 260-281.

⁸ Philip Goad and Julie Willis, *The Encyclopedia of Australian Architecture* (Port Melbourne, Victoria: Cambridge University Press, 2012).

focused on Australian architectural firms.⁹ A broader contextual picture of the rise of modernism after World War II has been covered for Melbourne,¹⁰ and for Australia,¹¹ but not with the specific scope to investigate tall buildings. A specific focus on Melbourne's office buildings was touched in 2006 by Marika Neustupny, but with a confined focus on curtain walls and within a timeframe of twenty years, between 1955 and 1975.¹²

Secondly, urban studies on Melbourne for the same period may have given historical accounts for different periods and from other disciplinary perspectives, but not with the specific target to deal and analyse tall buildings in the city as a critical nexus between architecture and techno-economic developments. The history of property development in Melbourne from the late 1800s to the early 1900s was written by Michael Cannon in 1966,¹³ and expanded more recently by Graeme Davison.¹⁴ The historical development of the central city of Melbourne, from the settlement of the city in 1835 to 1975, was exhausted by Miles Lewis in 1995.¹⁵ In this definitive historical account of the city, the development of high-rise in the second half of the twentieth century is, however, condensed within the panoramic picture of general history, government, town planning, public works, social development, utilities, city economy, building, architecture and streetscape.¹⁶

There are also heritage urban studies focused on the destructive aspects of the transformations of Melbourne's central city. One has given account through the vicissitudes of a demolition contractor,¹⁷ and another from the historical perspective of

⁹ Philip Goad [ed.] *Bates Smart: 150 Years of Australian Architecture* (Fishermans Bend, Melbourne: Thames and Hudson, 2004); Philip Goad, Rowan Wilken and Julie Willis. *Australian Modern: the Architecture of Stephenson and Turner* (Carlton: Melbourne University Publishing, 2004).

¹⁰ Philip Goad and Julie Willis. *Invention from War: a Circumstantial Modernism for Melbourne Architecture* (London: Spon, 2003).

¹¹ Philip Goad, Andrew McNamara and Ann Stephens. *Modern Times: the Untold Story of Modernism in Australia* (Carlton: Melbourne University Publishing, 2008).

¹² Marika Neustupny, *Curtain Call: Melbourne's Mid-Century Curtain Walls* (Melbourne: RMIT Publishing Press, 2006).

¹³ Michael Cannon, *The Land Boomers* (Carlton, VIC: Melbourne University Press, 1966).

¹⁴ Graeme Davison, *The Rise and Fall of Marvellous Melbourne* (Melbourne: Melbourne University Press, 2004).

¹⁵ Miles Lewis, *Melbourne: the City's History and Development* (Melbourne: City of Melbourne, 1995).

¹⁶ Lewis, "The Urban Spurt," in *Melbourne*, 127-139.

¹⁷ Robyn Annear, *A City Lost and Found: Whelan the Wrecker's Melbourne* (Melbourne: Black Inc, 2005).

the developments of one street.¹⁸ The Royal Historical Society of Victoria has recently released a publication that presents compelling imagery of demolished historic buildings compared with the buildings that followed after their demolition.¹⁹ These publications remind Melbournians of the *vulnus* inflicted to the city, in particular by the buildings of the post 1960s era, and induce to reflect on the perpetual processes of transformations of central business districts, which may be seen as destructive by some, but regenerating for others.

In Melbourne, there is perhaps still scope left to question what was lost in the CBD after the 1960s,²⁰ but there are questions still open concerning how and why so much of the architectural heritage in Melbourne's CBD was dilapidated after World War II. These patterns of transformation are not limited to the twentieth century. Since the Global Financial Crisis of 2008, Melbourne has seen a sudden resurgence of tall building activity. Concerns about the intensity and the levels of density of this wave of skyscrapers have been debated locally and in the international forum of the CTBUH.²¹ In 2016, only part of this new wave of high rise was built or under construction and another conspicuous part of it was still in prospect. This activity is almost entirely residential and located in the Central Business District (CBD) and started with the endorsement of the Liberal Government of the State of Victoria between 2010 and 2013.²² From 2014, the succeeding Labor State Government, in response to growing concerns about density and other matters of built-form control of high-rise buildings, initiated a radical process of revision of planning controls in the CBD. The outcome of this process was released in 2016 with the *Central City Built Form Review*.²³

¹⁸ Judith R. Buckrich, *Collins: the Story of Australia's Premier Street* (Melbourne: Australian Scholarly Publishing, 2005).

¹⁹ Richard Broome [ed.], *Remembering Melbourne: 1850-1960* (Melbourne: Royal Historical Society of Victoria, 2016).

²⁰ Heather Chapman and Judith Stillman, *Lost Melbourne* (London: Pavillon, 2016).

²¹ Giorgio Marfella, "The Future of Skyscrapers in Melbourne: from Hyper-Density to the Uplift Principle." In *Cities to Megacities: Shaping Dense Vertical Urbanism*, edited by Antony Wood, David Malott and Jingtang He, (Chicago: CTBUH, 2016). Proceedings of the CTBUH 2016 World Conference, Shenzhen, Guangzhou and Hong Kong, 16-21 October 2016, 379-386.

²² A surge of residential activity in the CBD, however, was strongly advocated since the 1990s by the local authority of the City of Melbourne with a planning policy known as "Postcode 3000".

²³ Victorian State Government and Leanne Hodyl, *Central City Built Form Review Synthesis Report*, (Melbourne: Victorian State Government, Department of Land, Water and Planning, 2016).

In the context of these recent developments, a process of substitution has begun since 2010 in the CBD, where a number of older multistorey office buildings, built mostly from the 1950s to the 1980s, are being demolished and substituted by residential towers. In order to mitigate the controversial density of Melbourne's boom of apartments, planning authorities have reinstated, in 2016, a set of controls based on plot ratios, which the city had already adopted before, in the 1960s, but phased out at the end of the twentieth century. In the second decade of the twenty-first century the city is traversing another stage of transformation, which has inadvertently brought to the fore the realisation that some planning models of the mid-twentieth century were perhaps not as ineffective as those of the most recent past. It is significant that - paraphrasing Goldberger - the planning authorities of State of Victoria decided to recur to policies of the 1960s to 'heal' the city from the most recent 'mistakes', which were perpetrated at the beginning of the twenty-first century.

In view of the importance brought by these contemporary events - and by the gap in the Australian literature mentioned earlier - a retrospective on the tall office buildings of the late twentieth century is therefore significant as a form of "operative criticism" that is urgently needed for the city of Melbourne.²⁴ The pertinence of an operative approach, of which the terms and definitions are borrowed from the Italian critic Manfredo Tafuri, applies *hic et nunc* for the Australian city. But, by inferred generalisation, this relevance could extend to an international family of tall buildings in other urban contexts too. The relevance is substantial especially for buildings completed between the 1950s and the 1990s, which in the twenty-first century may be, or soon become, under threat of demolition or radical alteration.

Furthermore, a longitudinal retrospective focused on Melbourne can offer the opportunity to test a methodology of research to explain the processes of formal change of tall buildings according to the techno-economic environments that surround them. The novelty of the approach consists in the search of patterns of recurrence that work in function of capitalist business cycles and major events of technological innovation.

²⁴ Manfredo Tafuri, *Theories and Histories of Architecture*, (London-Toronto-Sydney-New York: Granada, 1980), 141-170.

Having set aside the task to clarify the relevance of this retrospective, it is appropriate to introduce the methodology of research that is most fitting with this intent.

While the narrative of the modern movement evolved chiefly along the lines of the socio-aesthetic interpretation of architecture, some of the most informative pages given by historians of tall buildings have identified the importance of extra-architectural inputs, such as real estate economics, urban regulations and construction technology. In recent times, the acknowledgment of these factors has shown paths of research, where the architecture of tall buildings can be explained as the effect of external forces such as economic speculation and politics of built form control,²⁵ or as an eminently techno-pragmatic theatre where style, typology, construction and engineering converge and thus, by extension, strategic change in form arises from a response to a determined social and technological environment.²⁶

The intent of this thesis is not to dispute these last two theorems. Conversely, these positions are taken as the foundation where the hypotheses of the dissertation rest. The aim is to demonstrate, however, that while economic and regulatory stances interact – as a *conditio sine qua non* - with tall buildings, these stances operate on a plane that coincides and mirrors the one where architectural form develops along evolutionary patterns of technological change. In order to sustain this argument about the *ex aequo* importance of economics and technology in tall buildings, this study found appropriate to refer, beyond the disciplinary boundaries of architecture, to two modern authorities in economics and philosophy.

²⁵ Exemplar of this line of research is the work of the historian and director of the Skyscraper Museum of New York Carol Willis; see *Form Follows Function: Skyscrapers and Skylines in New York and Chicago* (New York: Princeton Architectural Press, 1995). Willis discussed several times at conferences of the CTBUH the applicability of the principles of *Form Follows Finance* to contemporary residential skyscrapers. See for example, Carol Willis, “The Logic of Luxury: New York’s New Super-Slender Towers,” in *Future Cities: Towards Sustainable Vertical Urbanism*, edited by A. Wood, proceedings of the CTBUH 2014 Shanghai Conference, China, 16-19 September 2014 (Chicago: Council on Tall Buildings and Urban Habitat), 357-364.

²⁶ Along this line of research is the recent work of Thomas Leslie on the skyscrapers of Chicago. See for example, *Chicago Skyscrapers, 1871-1934* (Urbana-Chicago-Springfield: University of Illinois Press, 2013). In 2016, the CTBUH awarded Leslie and two research students under his supervision a grant to undertake research on the “The Rebirth of the Skyscraper: Technical Advances, 1930–1975”. The study aims to “examine the impact of a handful of technical developments [...] on tall building performance [...] and their effects on building massing and fabric.” Full project description is available at <http://www.ctbuh.org/TallBuildings/CTBUHCompetitions/CTBUH2016StudentResearchCompetition/StudentResearchFundingWinner/tabid/7296/language/en-US/Default.aspx>

Schumpeter's work in the *Theory of Economic Development*,²⁷ and the circular, dynamic and qualitative-based model of the "process of creative destruction",²⁸ gives a conceptual framework where economics and technology can coexist with an equal share of influence in society. This model is still advocated today as a powerful tool in economic history and analysis by scholars and theorist of the business cycle and theorist of innovation. Further details on Schumpeter's theories and on the applicability of these beyond economics, are appraised in more detail in the Chapter 1. Here it is sufficient to note that, in line with Schumpeter's theoretical framework, long-term retrospective studies have a higher potential to explain major techno-economic cycles than those focused on short-term targets.

The ideal target of this type of studies is to cover an interval of time that is (1) wide enough to embrace a long wave of economic growth and downturn and (2) characterised by the likelihood of strategic – if not revolutionary - changes in building technology. With this end, the object of the research falls in the second half of the twentieth century. The skyscrapers of the inner city of Melbourne are an ideal choice for such a longitudinal study. In four decades the central area of the city was subject to radical and irreversible transformations that were triggered, above all, by tall office buildings. The specific focus on tall office buildings, as explained in Chapter 2, rests on the peculiar nature of such buildings, which can be considered *ipso facto* as a form of business itself.

Martin Heidegger's philosophical essay on the *Question Concerning Technology* is the second methodological stronghold of the dissertation, which is used instrumentally to isolate four fields of enquiry, investigation and significance.²⁹ Heidegger's unravelling approach to the problem of human technology - borrowed directly from Aristotelian metaphysics - is followed in this thesis with the scope of identifying a set of concomitant and interrelated 'causes'. These causes are clues to specific sub-fields of inquiry that pertain to an open research path, which would otherwise remain generic or stranded *ad infinitum* by regressive logical reasoning. The four causes of Aristotle and

²⁷ Joseph A. Schumpeter, *The Theory of Economic Development: an Enquiry into Profits, Capital, Credit, Interest, and the Business Cycle* (Cambridge, Massachusetts: Harvard University Press, 1934).

²⁸ Joseph A. Schumpeter, "The Process of Creative Destruction," in *Capitalism, Socialism, and Democracy* (London: Allen and Unwin, 1943), 81-86.

²⁹ Martin Heidegger, "The Question Concerning Technology, 1954." In *Readings in the Philosophy of Technology*, edited by David M. Kaplan (Lanham: Rowman and Littlefield, 2009), 9-24.

Heidegger – namely, the final cause (*causa finalis*), the efficient cause (*causa efficiens*), the formal cause (*causa formalis*) and the material cause (*causa materialis*) – are at the base of a set of research questions, which are presented in Chapter 2. These four causes are the linchpin of the thesis, which connects the reasons as to why a specific trend in tall building architecture emerged, changed and declined over time within a broader techno-economic process of creative destruction of the built environment.

The thesis is presented in eight chapters and structured conceptually in three parts that lead to conclusion in Chapter 8. The first two chapters are introductory. Chapter 1 provides an introduction to the critical problem of tall building architecture and to the Schumpeterian postulation of the process of creative destruction. Chapter 2 formulates the research questions, which motivate the methodological background used to identify patterns of change over a period generally considered as a moment of transition and discontinuity, from modernity to post-modernity.³⁰

Chapter 3, Chapter 4 and Chapter 5 present in three temporal steps the development of tall buildings in the central city area of Melbourne. These three chapters investigate the buildings within specific place coordinates and under the lens of changes in architectural typology. There, reference is given chiefly to development feasibility and purpose, qualitative expectations of spatial efficiency, and public influence and control of built form. Within each of these three chapters, one paragraph is dedicated to describe the evolution of regulatory context of the city. These paragraphs are presented in the central part of the chapters – not at the beginning and not at the end – in order to strengthen a narrative that presents regulatory controls in a state of flux that proceeded *pari passu* with building developments. This is intentional to prevent the misunderstanding of the regulatory context of Melbourne as a superstratum of causal influence from which building trends followed as an effect.

Chapter 6 and Chapter 7 expand beyond the geographic boundaries of Melbourne and sustain that the phenomenon analysed in the Australian city was arguably of international relevance. This part presents evidence of an architectural and techno-

³⁰ Steven A. Moore, “Technology, Place and the Nonmodern Thesis,” *Journal of Architectural Education* 54, no. 3 (February 2001): 130-139.

economic parallelism between Australia and the United States of America during the second half of the twentieth century, which is attested by similarity of trends in architectural typology and strategic patterns of technological change. The considerations that concern more directly the USA are used to corroborate the in depth evidence presented for Melbourne. The observations on the American counterpart should not be misread, in reverse, as an implication that American developments were an antecedent equivalent that mirrored the events of Melbourne. Chapter 7 has limitations that derive from the difference of sources used to investigate American buildings, which, within the limits of this study, could not be verified with the same level of penetration that was possible with sources accessible in Melbourne. Chapter 7 is a first step that proposes a sequel that may lead to further studies of international significance, which may confirm by comparison the findings of Melbourne or may take to different directions and conclusions in reference to different urban contexts.

The more painstaking considerations about the methods of data collection and the temporal and geographical limits of this study are outside the main body of the thesis, in the appendices, which contain also location maps, charts, illustrations, data sets and data sheets of selected buildings. Reference to this material is made throughout the dissertation in square parentheses that take, with reference to numerous buildings, to maps and data sheet locations. This method of reference is used particularly from Chapter 3 to Chapter 6 and to a minor extent in Chapter 8, where the findings are re-assembled narratively according to the fourfold scheme of causation and questions presented in Chapter 2.

In summary, the core of the dissertation is conceptually split into two sections that - in virtue of the evidence given by the buildings analysed - are ultimately reconciled in the conclusions as two sides of a same coin. The first section – from Chapter 3 to Chapter 5 - explains changes of architectural form according to inputs of building economics, urban development and policy within the geographical limits of Melbourne. The second section – presented in Chapter 6 and Chapter 7 - explains patterns of formal change with the context of strategic technological developments and innovations that pertained to a broader - albeit still limited - milieu that linked Melbourne, Australia and the United States of America.

Chapter 1

Skyscrapers and the logics of the three F's

The paradox of box architecture considered against finance, fashion and function

Melbourne needs fresh air. It is a conglomeration of totally unskilled shoe-boxes. There are such things as skilled boxes. I like some of the box architecture in Melbourne – the BHP building, the AMP Centre, and I like Collins Place, up to a point.

Harry Seidler, 1985¹

Can the architectural quality of tall buildings be determined by their form? Is there a set of architectural skills or knowledge that can be linked to the quality of space in a certain building typology? Or is the form of tall buildings simply the result of factors that are external to architecture?

Limiting the discussion to the typology of tall office buildings, the elements that define their form are the shape of the floor plan and the relationship of the latter with another element, the service core. Often, in commercial buildings, the floor plates are stacked on top of one another with hardly any geometrical variation from floor to floor. Therefore, a simple two-dimensional arrangement, which defines the shape of the floor plan and its position in relation to the service core, and the number of floors above ground – or building height – are enough to entail the overall three-dimensional form of the building. So, for example, if the floor plan is a square or a compact rectangular shape and the core is inside the floor plan, then the result is a monolithic skyscraper. In other words, borrowing from Harry Seidler's quote, it is "box architecture". If the plan is rectangular with an aspect ratio of more than one to one and a half, then the result is still monolithic, but also commonly referred to as a "slab".

In some instances, geometrical modifications of the built-form are introduced progressively with height, but these variations are secondary. Given the large scale of

¹ Quoted by Kevin Childs, "Plan for S-Shaped Building Sparks Row," *The Age*, November 18, 1985, 3.

many tall office buildings, these changes often do not alter the basic perception established by a monolithic volume.



Figure 1.1
Melbourne, Central Business District, aerial views, 2010

Observing the skylines and aerial imagery of inner districts in Australian capital cities, it is possible to map a range of permutations of office floor plan types. (See Figure 1.2)

Tall office buildings in Melbourne, Sydney, Brisbane, Adelaide and Perth often have rectangular plans made by two adjoining or intersecting rectangles. Rectangular, perfectly square or “squarish” - e.g. with aspect ratio of less than 1 to 1.5 - floor plans are very common. In many cases, the square is slightly chamfered at the corners; at times, the chamfers are so pronounced to transform the plan into an octagon. Squares, and rectangles alike, are sometimes multiplied into cellular arrangements that create eight-shape floor plans. In Australia there are also examples of curved office buildings, mostly with floor plans made of segments of an arc. In some cases, curves are condensed into a pure circular or elliptical shape. Less commonly, the floor plans are trapezoidal, rhomboidal, hexagonal or triangular. In some cases, the floor plan cannot be reduced to any of these pure

geometric shapes, but some compositional method, which generally combines regular polygons with circular curves into a hybrid floor plan, can still be recognised.

AUSTRALIAN TALL OFFICE BUILDINGS MATRIX OF COMMON FLOOR PLAN TYPES		A CENTRE CORE	B SIDE CORE	C END CORE
1 RECTANGULAR				
2 MULTI-RECTANGULAR				
3 QUASI-SQUARE				
4 SQUARE				
5 SQUARE-OCTAGONAL				
6 DOUBLE-SQUARE				
7 CURVED				
8 CIRCULAR/ELLIPTICAL				
9 ROMBOIDAL-EXAGONAL				
10 TRAPEZOIDAL				
11 TRIANGULAR				
12 HYBRID				

Figure 1.2

Permutation matrix of tall office floor plan types based on Australian buildings

In relation to the floor plate, the service core can be located internally as a central shaft, and be centred symmetrically along one or two axes. In these cases, the configuration is referred to as a “centre core” plan. Alternatively, the core can be shifted inside to one side, or to one or both ends of the floor plan. A core that is located along the longer side of the floor plate is generally referred to as a “side core”. If the core is located on the shorter side of the floor plate, it is generally referred to as an “end core”. Side cores and end cores can intersect with the floor plan, be detached at one of the sides, or can be inscribed within the floor plan by aligning to one or more of the sides. Considering configurations generated by the three types of (a) centre core, (b) side core and (c) end core, and limiting the number of plan shapes to twelve - as derived from observations in Australian cities - the possible permutations of tall office building floor plan types are at least thirty-six.

This evidence from built examples in Australia, clarifies that, generally, the formal possibilities of office buildings are limited, and considering the singular case of a city, the patterns of recurrence are based on an even smaller number of variations. In fact, observing the buildings in Melbourne, it can be observed that only a few configurations are dominant (See figures 1.3 and 1.4). Five out of the ten tallest office buildings of the city are towers with square floor plans and centre cores. This type would fit within Seidler’s definition of “box architecture”. The other five tallest office buildings in Melbourne are not exactly square centre core types, but they belong to types that share some affinities. Two are quasi-square - or squarish - in plan with a centre core; one of them is octagonal with a centre core; the other two consist of two centre core square towers joined side by side to form an 8-shaped plan. Square plan office towers, or squarish types, prevail in Melbourne particularly among the tallest towers. In chronological order of completion, AMP Square (113 metre high, completed in 1969), BHP House (152 metre, 1972), Nauru House (182 metre, 1977), Collins Place (185 metre, 1981), Rialto (251 metre, 1986) and 120 Collins Street (265 metre, 1991), have raced to hold, for some period of time, the status of tallest building in the city. If the sample is extended to include buildings less than one-hundred metres tall, the rectangular type is also common. In fact, three buildings of this type, ICIANZ House (84 metre, 1958), CRA Building (99 metre, 1961) and Commonwealth Bank House (154 metre, 1975), can be added to the sequence of the tallest record holders of the city. [See appendix A, table A.3]



Figure 1.3
Tall office buildings in Melbourne CBD with rectangular floor plan type



Figure 1.4
Tall office buildings in Melbourne CBD with square or quasi-square floor plan type

In Melbourne there is therefore a self-evident correlation between height, or tallness, and the monolithic form of square tall office buildings, which are generally pervasive in the

city. But is this phenomenon connected with architectural quality? Or, beyond Harry Seidler's remark about Melbourne, is this formal homogeneity connected with the technical skill of designers or with the character of the place? What are the determinants that make some monolithic buildings more "skilled" than others? AMP Square, BHP House and Collins Place were three projects designed by Australian-American joint ventures. Was "skill", in these three cases, know-how not available in Melbourne?



Figure 1.5

"Skilled boxes": AMP Square, Melbourne, 1965-69, designed by Skidmore Owings Merrill in collaboration with Bates Smart and McCutcheon (left); BHP House, Melbourne, 1969-72, designed by Yuncken Freeman in collaboration with Skidmore Owings Merrill Chicago (middle); Collins Place, Melbourne, 1971-81, designed by I.M. Pei and Associates New York in collaboration with Bates Smart and McCutcheon (right)

1.1 Economic ubiquity and creative destruction

Does form follow finance?

Defining skyscrapers

Before addressing these opening questions, it is necessary to provide a coherent definition of "skyscraper" and "tall building", two terms that are used interchangeably hereafter.

In 1936, British architectural historian Nikolaus Pevsner attempted to assign a meaning to the word "skyscraper" for the vocabulary of his time. Pevsner stressed the importance of elements of technical innovation. For example, modern skyscrapers were made possible by the introduction of a safe system of vertical transportation that was practical to build: the electric lift. But structure, Pevsner explained, was what mattered above everything else:

“not every tall building is a skyscraper. We use the term only where load-bearing walls are replaced by skeleton construction.”²

Pevsner's definition was later expanded in his *History of Building Types*, where skyscrapers were included in the same functional group of warehouses and offices. The historian indicated an element of distinction that skyscrapers must have from their immediate surroundings. A skyscraper is a building that “must be distinguished by some height above those surrounding it to give the impression of scraping the sky.”³ Leaving aside the apparent tautology of this sentence, Pevsner's definition implies that a building is defined as a skyscraper in relation to its urban context, and not “only”, as the critic had previously envisaged, in exclusive terms of technology.

The two definitions given by Pevsner, if reconciled, coincide with the cornerstone of the definition of “tall building” endorsed by the Council on Tall Buildings and Urban Habitat (CTBUH). According to this widely accepted definition, a tall building is one that combines a physical dominance of “height relative to context” with elements of specialised “building technologies” like, for example, lifts and structural solutions governed by horizontal actions such as wind and earthquakes.⁴

In view of these definitions, the architectural quality of tall buildings stems, on the one hand, from the conditions of a place and, on the other hand, from a design response of technological specialisation. However, using an example proposed by Italian semiologist Umberto Eco, these formal and material definitions of “verticality” in architecture do not necessarily explain the broader, and not univocal, significance of skyscrapers. In other words, using Eco's terminology, the “denotation” of a vertical building does not necessarily imply a unique “connotation”.⁵ A Neo-Gothic cathedral in New York, even if “miniaturised” in scale in comparison with the skyscrapers nearby, is still able to denote verticality and, at the same time, connotes a sense of mysticism and elevation to God. A tall office building in New York can also denote verticality, but it can hardly have a

² Nikolaus Pevsner, *Pioneers of Modern Design from William Morris to Gropius* (Hammondsworth, UK – Ringwood, VIC: Penguin, 1960 [1936]), 116.

³ Nikolaus Pevsner, *A History of Building Types* (London: Thames and Hudson, 1976), 219.

⁴ Council on Tall Buildings and Urban Habitat, *Criteria for the Defining and Measuring of Tall Buildings*. Available at <http://www.ctbuh.org/HighRiseInfo/TallestDatabase/Criteria/tabid/446/language/en-GB/Default.aspx> (accessed 24 April 2015).

⁵ Umberto Eco, *La Struttura Assente* (Milano: Bompiani 1968), 209-210.

religious connotation, even if the building has a Neo-Gothic style. The connotation of these buildings is open, multifaceted and not univocal, but one connotation that is certainly more relevant than a generic aesthetic expression of verticality is that of business. On this basis, the definition of skyscrapers that are also office buildings, or buildings for business, cannot abstain from this essential connotation.

Skyscrapers and business cycles

Given these definitions, it can be argued that the formal homogeneity of modern skyscrapers derives from business imperatives, where economic forces are the cause and tall buildings the effect. In fact, tall buildings have been explained as a phenomenon linked to macro-economic trends of growth and production, and in this sense, skyscrapers can be considered as a form of capital goods. From another perspective, tall office buildings can be considered as a particular type of building, one that is a form of business in itself. In both these interpretations, it is pertinent to associate the production of tall office buildings with business cycles, and from the interrelation between skyscrapers and economic cycles derives the suggestion that skyscrapers can be considered as indicators of global economic trends.

One example of such global macro-economic associations is the “Skyscraper Index”, a theory proposed by economic analyst Andrew Lawrence in 1999.⁶ Lawrence hypothesised a number of correlations between the chronological series of the tallest buildings completed worldwide and events of global economic crisis. The pattern followed by the Skyscraper Index is this: record-breaking skyscrapers are announced at a peak of market optimism, during economic booms. Subsequently, due to the time-lags imposed by the construction process, these skyscrapers are completed during or at the onset of a period of recession. The Skyscraper Index suggests that there is a component of irrational investment at the base of the decision to build record-breaking skyscrapers. The index suggests also that this exuberance is usually associated with monetary policies driven by ease of credit, which fuels real estate bubbles. Lawrence recognises that some exceptions in the series may occur, but nonetheless, according to its supporters, the Skyscraper Index is a

⁶ Andrew Lawrence, *The Skyscraper Index: Faulty Towers*, property report, Dresdner Kleinwort Wasserstein Research, January 1999, cited in Mark Thornton, “Skyscrapers and Business Cycles.” *Journal of Austrian Economics* 8, no. 1 (2005): 74; See also Andrew Lawrence, interview by Kevin Brass, “Talking Tall: the Skyscraper Index,” *CTBUH Journal* (2012, 2): 42-44.

meaningful indicator of the correlation of business cycles with the built environment. The time series of the index is also seen as an underlying element in support of business cycle theories that link the cyclic growth of business to the effects of interest rates and monetary policies. This line of thought is upheld by the economist Mark Thornton, who also considers skyscrapers as a prominent indicator of business activity.⁷ Periods of economic activity that induce to “entrepreneurial error” are followed in the cycle by a phase of “bust”:

The skyscraper is the critical nexus of the administration of modern global capitalism and commerce where decisions are made and transmitted throughout the capitalist system and where traders communicate and exchange information and goods, interconnecting with the telecommunications network. Therefore it should not be surprising that the skyscraper is an important manifestation of the twentieth-century business cycle, just as the canals, railroads, and factories were in previous times.⁸

The connection between skyscrapers and business cycles is explained by Thornton in terms of Cantillon effects,⁹ or effects that denounce increased money circulation as the cause of excessive investments in capital goods. This explanation implies that record-breaking skyscrapers are capital goods, as opposed to consumer goods, since they are conceived as investments in “roundabout production processes”.¹⁰ In other words, like railroads, canals, factories and communication systems, skyscrapers are investments aimed to extract more value from the production process, rather than accumulate goods or additional profits.

The validity of the correlations of the index has been analysed and supported also by other economists. For these economists, in summary, the skyscraper index is proof of the artificial powers of stimulation of central banks and of the patterns of entrepreneurial error that are intrinsic to business cycles.¹¹ The proponents of this theory, however, have clarified that the index should not be misunderstood as a tool of forecast or as criterion to inform monetary policy. The Skyscraper Index is simply “a powerful illustration of the role of Cantillon effects”.¹²

⁷ Thornton, 51-74.

⁸ Thornton, 58.

⁹ Cantillon effects are named after the Irish-French economist Richard Cantillon (1680s -1734).

¹⁰ Thornton, 68-69.

¹¹ Greg Kaza, “Note: Wolverines, Razorbacks and Skyscrapers,” *Journal of Austrian Economics* 13, no. 4, (2010): 74-79.

¹² Thornton, 79.

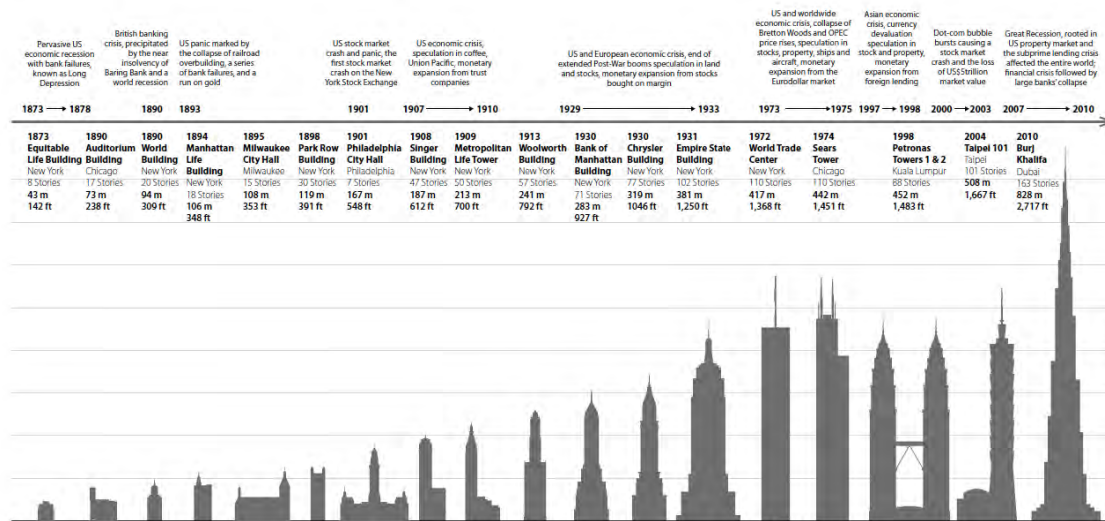


Figure 1.6
The Skyscraper Index

Economic equilibrium and office buildings

The theory behind the Skyscraper Index is object of controversy, and its validity as an economic indicator has been criticised on grounds of scientific reliability. The opponents to the theory claim that surges of tall building activity are not necessarily indicators of economic crisis.¹³ The production of tall office buildings, for example, is a simple function of supply and demand of working space. According to this, skyscrapers can be correlated more reliably with the growth of the Gross Domestic Product (GDP) of a nation. Office building production, in this line of thought, stems basically from the need of space for tertiary employment, and output is governed by a self-regulating balance of supply and demand of floor space.¹⁴

On one side of the balance, the demand for office space is thought to be driven by three factors: (1) general growth in the labour force; (2) shifts in the labour force towards tertiary occupations; (3) technological changes affecting the amount of space required for workers. An example of the last factor is the introduction of new equipment in the office space like typing machines or personal computers.¹⁵

¹³ Jason Barr, Bruce Mizrach and Kusum Mundra, "Skyscraper Height and the Business Cycle: International Time Series Evidence," Rutgers University Working Paper, December 2011. Available at SSRN: <http://ssrn.com/abstract=1970059> or <http://dx.doi.org/10.2139/ssrn.1970059> (accessed 12 March 2015).

¹⁴ Anthony Downs, "Cycles in Office Space Markets," in *The Office Building: from Concept to Investment Reality*, edited by John Robert White (Chicago: Real Estate Counsellors 1993), 153-169.

¹⁵ Downs, 155-160.

On the other side of the balance, the supply of office space is thought to be influenced by factors such as current and expected levels of rents, credit availability, quality of the infrastructure, tax policy on real estate and land and construction costs. This process seeks equilibrium, and tenant vacancy rates work as the pivot that balances supply and demand of space.

In this model, business cycles outlined by the GDP of nations are a more meaningful influencer of tall building activity. Economic growth works to augment the three factors that increase demand space in cities; accordingly, variations of tall building production are dampened or amplified by oscillations over time.

In fact, the production of office buildings has been shown to have, a correlation with historical unemployment rates in the United States.¹⁶ Evidence of the correlation between building height and business cycles expressed by national GDP time series, has been shown to exist in cities of the United States and Canada and in Hong Kong. The economists who dismiss the skyscraper index suggest that rising incomes, and not necessarily low interest rates, may be a more systematic factor of influence in the production of tall office buildings.¹⁷

At any rate, the dispute around the Skyscraper Index, originates from positions that are difficult to reconcile due to different aims and methods of analysis. The line of thought of the proponents seeks a qualitative assessment of major events of political economy, like widespread economic irrationality and monetary policies. The line of thought of the opponents is quantitative and aimed to seek correlations and methods of forecast on a statistical basis. Both positions, however, start from the assumption that tall buildings are an indicator of economic output subject to cyclic activity, and therefore they can be understood, over time, as a kind of business activity in itself.

¹⁶ Downs, 158-159.

¹⁷ Barr, Mizrach and Mundra.

Business cycles and creative destruction

At this point, it is pertinent to introduce another line of thought, the one of the Austrian-American economist Joseph Schumpeter,¹⁸ which, albeit not connected explicitly with skyscrapers, has the merit to connect historical economic fluctuations with processes of techno-economic innovation. Schumpeter, in the *Theory of Economic Development*,¹⁹ proposed the existence of a structural and perpetual process of change, which is able to upset the economic mechanisms of “circularity” and “equilibrium” of supply and demand. The process describes the origin and dynamics of business cycles.²⁰

The Harvard economist considered technological progress and entrepreneurial will as the triggers of a destabilising form of development described as the “process of creative destruction”.²¹ In this theory, technological innovations inspire and augment competitive behaviour and become superseding factors of older products and methods of production. According to Schumpeter, innovation drives a cyclical process that follows this steps: (a) at first, some entrepreneurs gain a competitive advantage as a result of successful innovative efforts; (b) the perception of economic advantage brought by innovation expands from the innovators to the rest of the competitors; (c) this leads to irrational oversupply *en masse*; finally, (d) the oversupply is adjusted with recession and, under some conditions, (e) it is followed by depression. Schumpeter defined innovation in this process as the result of “new combinations” of existing materials and methods of production, which can take place to produce new things or make existing things with new methods of production.²² (See figure 1.7)

Innovation, according to Schumpeter, can derive from five types of new combinations: (1) the introduction of new goods or goods with new qualities; (2) the introduction of new methods of production; (3) the opening of new markets; (4) the availability of new raw materials or half-manufactured goods; and (5) the reorganisation of an existing industry.²³

¹⁸ Joseph Alois Schumpeter (1883-1950) was an Austrian-born political economist who, in 1932, moved to the United States, where he taught and researched as Professor of Economics at Harvard University.

¹⁹ Joseph Schumpeter, *The Theory of Economic Development: an Enquiry into Profits, Capital, Credit, Interest, and the Business Cycle* (London – New Brunswick, NJ: Transaction: 1983 [1934]).

²⁰ Schumpeter, 57-94.

²¹ Joseph Schumpeter, “The Process of Creative Destruction,” in *Capitalism, Socialism and Democracy* (London: Allen and Unwin, 1943), 81-86.

²² Schumpeter, *The Theory of Economic Development*, 65-66.

²³ Schumpeter, 66.

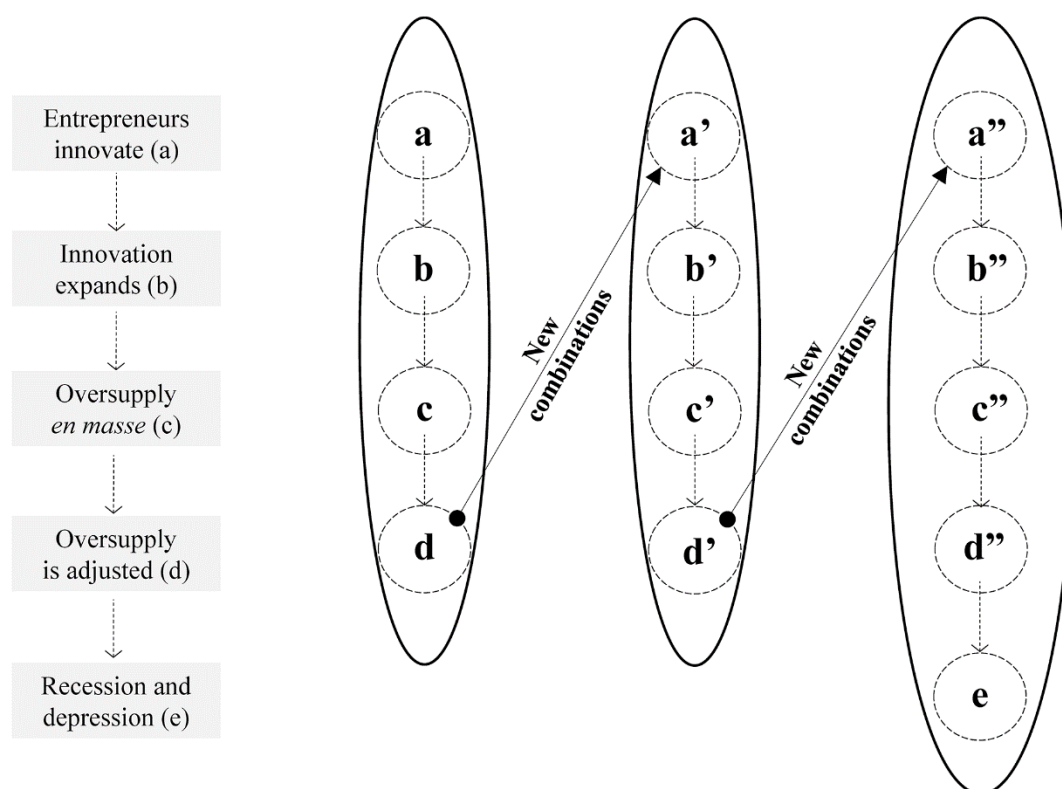


Figure 1.7
Schumpeter's process of creative destruction

On a temporal scale, the process works with different degrees of change and follows a “composite” business cycle of “many simultaneous waves”.²⁴ Economic fluctuations can occur within time intervals of up to 45-60 years, characterised by major technological shifts and known as a Kondratieff waves. These long waves are formed by the sequence of smaller waves, which can take place in short time intervals of 3-4 years (Kitchin wave), or medium intervals of 9-10 years (Juglar). Long periods of depression, according to Schumpeter, can result by the coincidence of the nadir of long (Kondratieff) and medium (Juglar) waves.²⁵

²⁴ Joseph Schumpeter, *Business cycles: a Theoretical, Historical, and Statistical Analysis of the Capitalist Process* (New York: McGraw-Hill, 1939), Volume 1, 212-220.

²⁵ Schumpeter, 162-173.

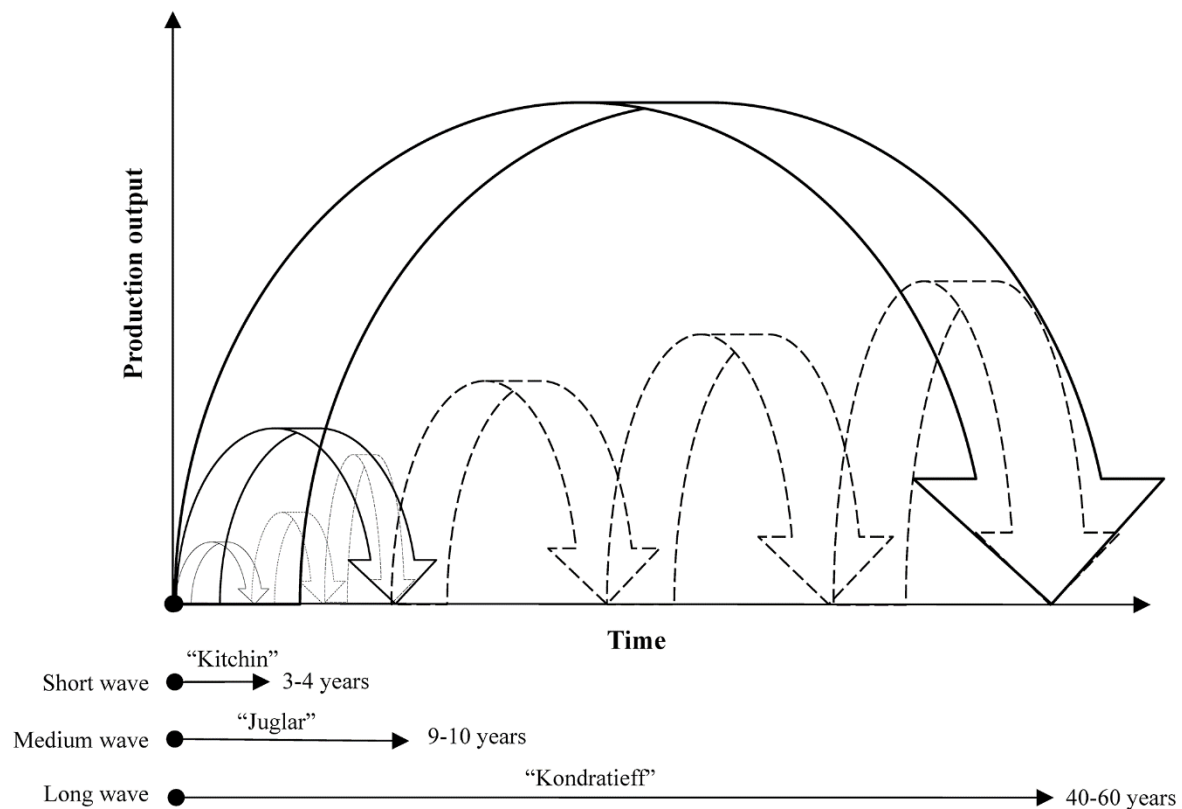


Figure 1.8
Composite business cycles based on Schumpeter

In this framework, economic change is explained dynamically, in relation to technological development and, above all, qualitatively and not merely by quantitative parameters of equilibrium between demand and supply. Economic output is a process in constant evolution driven by technological change; the agent of change is the entrepreneurial drive of capitalists to compete, experiment and take risks beyond a calculated rationale of optimal return. Capitalist entrepreneurs therefore induce, motivate and participate in historical moments of technological development and are agents of the ensuing breakdowns of the capitalist system. Instead of a static, self-adjusting and repeating economic circle of supply demand, the process of creative destruction explains capitalism as a process that strives for perpetual change and not for equilibrium. The occurrence of

sudden revolutions occurs, however, in the context of an “evolutionary” perspective that contemplates also moments or marginal change and periods of temporary equilibrium.²⁶

In synthesis, tall building activity – as inferred by the positions of the economists reviewed earlier – is connected to business cycles. Hence, by analogy, it is plausible to describe this type of buildings as creative destructors of the built environment. Historically, skyscrapers may show trends to supersede older buildings that are perceived aesthetically obsolete and/or economically unproductive. Moreover, tall buildings, as a typology that has – by definition – a certain level of technological specialisation, may be, in a full Schumpeterian sense, a phenomenon of creative destruction induced by techno-economic development.

Following on from this assumption, it is required to review if this building typology has a tendency to evolve by superseding others types and to see if this typology is susceptible and receptive of technological changes. Irrespective of whether tall office buildings may be a qualitative indicator of upcoming downturn, Cantillon effects, or monetary policies, or a quantitative manifestation of GDP, demand of workspace or growth of salaries, tall building activity in a city over time is related to business cycles. Then, with a provisional suspension of judgment, it is plausible to assume that this building type may operate as a form of creative destruction in the built environment. But does the form – and not simply the output - of skyscrapers respond to economic factors?

Business logics and form

Carol Willis has assessed the tall building architecture of New York and Chicago in her comparative study *Form Follows Finance*,²⁷ where she concluded that the form of the early skyscrapers of the two cities were inseparable from considerations of economic nature.

Willis, by recognising the prevailing speculative character of the tall buildings of the two American cities, identified the importance of economic-programmatic formulas as a primary influence on architectural design. Speculative logics, in her thesis, prevailed over

²⁶ Schumpeter, *The Theory of Economic Development*, 57-94; Schumpeter, “How the Economic System Generates Evolution,” in *Business Cycles*, 72-129.

²⁷ Carol Willis, *Form Follows Finance: Skyscrapers and Skylines in New York and Chicago* (New York: Princeton Architectural Press, 1995).

the common place of aesthetic reasoning, which, by contrast, often interpreted skyscrapers as totems of corporate power:

The common cliché “the corporate skyline” suggests that American cities have been dominated by structures built by and symbolic of “Big Business”. The phrase offers easy shorthand for the increasing influence of corporations in the country's economy and culture, but it is profoundly misleading as a description of the dynamics of downtown growth. In all periods, the majority of skyscrapers have been speculative, not corporate buildings. Central business districts, or CBDs, must be understood as complex, competitive markets where space is a commodity, and location and image count.²⁸

Early American tall office buildings, for Willis, had to respond to market formulas to provide generic and flexible space. Historically, since even corporate building owners acted as investors, the rentability of office space in New York and Chicago was a far more important factor than corporate imagery. According to this mechanism, developers always built to maximise area to reach an optimal supply that matched output with fluctuating land values and demands of office space. Willis concluded:

Rather than interpreting corporate skyscrapers as representations of big business, we need to understand them as “business themselves”. Both corporate and speculative buildings are part of a marketplace where the space is for sale, and location and image have value.²⁹

The second stronghold of *Form Follows Finance* was to demonstrate that local conditions in New York and Chicago had a profound impact in determining differences of volume and typology in the skyscrapers of the two cities. Willis defined the skyscrapers of New York and Chicago as “vernaculars of capitalism”, in other words, an architectural type that was “less designed than evolved in response to functional demands.”³⁰ According to this thesis, skyscrapers may have similar forms, but different urban contexts can influence with significant variations from place to place. These comparative observations were limited in time to the first half of the twentieth century. The skyscrapers of the period after the World War II, described as international, were not influenced to the same extent by localism:

I use *international* [sic] to describe the period after 1950. Although evocative of the International Style aesthetics of steel, glass, spatial volumes, and structural expression, the term is not intended to be exclusively stylistic: rather, it suggests the relationship – or lack thereof – between the form of a building and its site and surroundings. In this framework, international refers to the fact that advances in technology as well as changes in architectural

²⁸ Willis, 153.

²⁹ Willis, 153.

³⁰ Willis, 8.

ideology made tall buildings independent of their sites and essentially interchangeable from one city to another. Even postmodern contextualism is international by this definition.³¹

In summary, from the point of view of the economist, it may suffice to underlie causes and effects on changes of the built environment in view of general output and economic theories. But if the target of the investigation is architectural form, it is critical that economics is supported by at least another two sources of influence. Tuning into an economic rationale may be a necessary condition of development, but this can hardly be sufficient to explain in full the architectural results.

Economics is only one third of a tripartite scheme of influence on tall office buildings. There are another two determinants to consider, which are implicit in the definition of a skyscraper: urban context, or place, and technology. If buildings are conceived for business or, as it may often be the case, for rental purposes, it is likely that economics, business cycles, economic growth, finance and speculation can be highly influential. But among the multiple causes that may trigger the construction of large numbers of tall office buildings, the physical and socio-economic contexts of a city, region, nation or international milieu also play a primary role.

1.2 Destruction, crisis, vernaculars, memory and destruction again

Does form follow fashion?

Uncreative destruction?

Tall office buildings of the second half of the twentieth century had a destructive impact on the historical city centres of North America and Australia. Cultural debate from the 1950s onwards suggests affinities between the two continents. In that debate, the theme of heritage destruction prevails alongside that of an argued lack of creativity associated with the design of monolithic skyscrapers. After World War II, opposition grew against the architecture of this building typology. The negative stance of destruction brought by tall office buildings overcame any positive contemplation of urban regeneration that could derive from this type of developments. It was under these circumstances of cultural dispute and antagonism that conservation movements were born in North America and Australia.

³¹ Willis, 7.

In the 1950s, Jane Jacobs analysed the “logic of its own” with which the post-war office boom in Manhattan congested 116 new tall office buildings in a short period of time.³² In Australia, more than a decade after Jacobs’ influential *The Death and Life of Great American Cities*, Leonie Sandercock published a book titled *Cities for Sale*. The modern-inspired urban renewal policies of the City of Melbourne were argued by Sandercock to be “crude and uncivilised” capitalism.³³ Land taxation by local government and “profit maximising” logics by private interests went, according to Sandercock, hand in hand as two sides of the same coin.³⁴

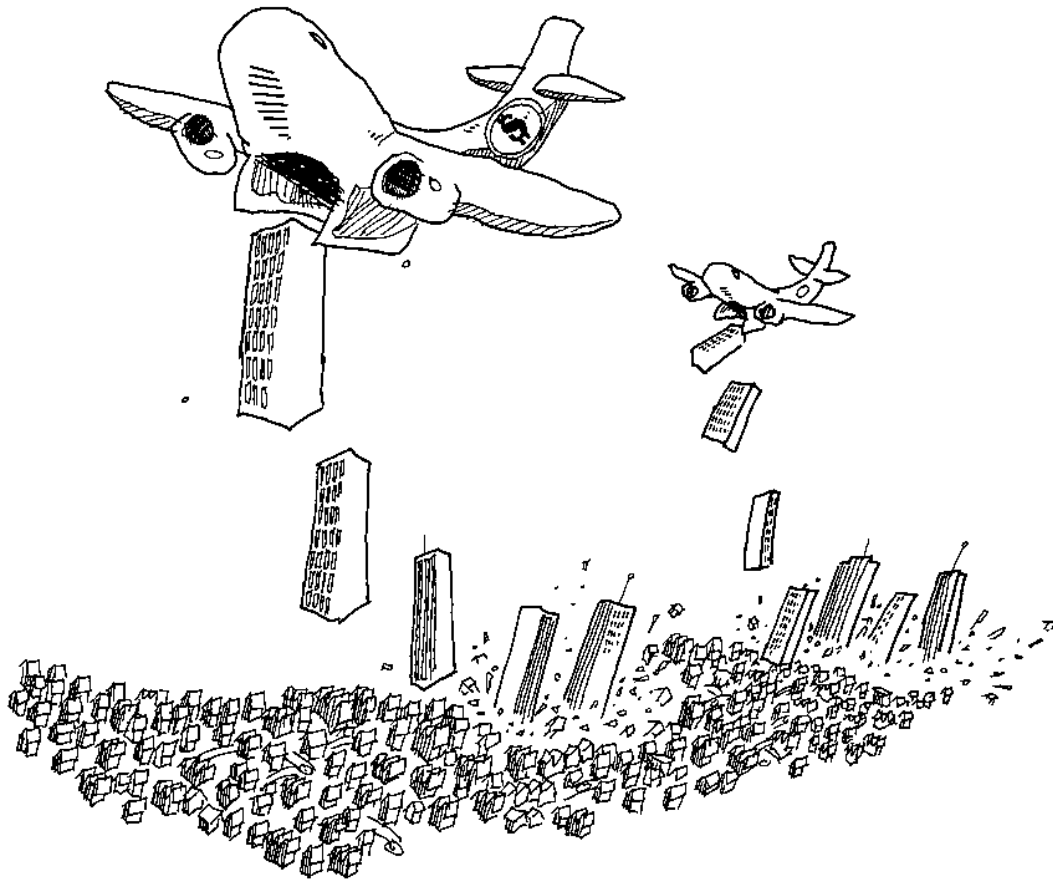


Figure 1.9

Cartoon showing that “Highrises breed more highrises” according to heritage conservationists of San Francisco, 1971

³² Jane Jacobs, “New York’s Office Boom,” *Architectural Forum* 106, no. 3, (March 1957): 104-113.

³³ Leonie Sandercock, “Melbourne: Capitalism, Crude and Uncivilized,” in *Cities for Sale* (Melbourne: Melbourne University Press, 1975), 145-175.

³⁴ Sandercock, 155.

As early as 1959, the American journal *Progressive Architecture* “re-assessed” critically the Seagram House,³⁵ and in 1963, the Pan Am Building in New York was described as a “Behemoth”.³⁶ From the mid-1960s onwards, the editors of the journal then moved to debate the “war on ugliness”.³⁷ In synchrony, conservation movements flourished in San Francisco where the destructive political and economic motives behind downtown commercial developments were unravelled by a number of architects, planners and sociologists. One Californian architect concluded that, notwithstanding the *noblesse oblige* of some examples, the new tall “monoliths” of commercial developments of the times could barely be considered architecture.³⁸



Figure 1.10

The war on box architecture, from America in *Progressive Architecture* (left) to Australia in *Architecture in Australia* (right)

American heritage influences crossed the Pacific Ocean and reached Melbourne in the 1970s. First with the Collins Street Defence Movement and, later on, with the preparation of the National Trust's preservation study known in the city as the “Collins Street

³⁵ “A Critique of Critiques: Seagram House Re-assessed,” *Progressive Architecture* 40, no. 6 (June 1959): 140-146.

³⁶ “The Pan Am Building: a Behemoth is Born,” *Progressive Architecture* 43, no. 3 (April 1963): 61-62.

³⁷ “The War on Ugliness,” *Progressive Architecture* 47, no. 6, (June 1966): 140-160.

³⁸ John Keynon, “Damned Monoliths: an Architectural Critique of Highrise,” in *The Ultimate Highrise: San Francisco's Mad Rush Toward the Sky*, edited by Bruce B. Brugmann and Greggar Sletteland (San Francisco: Bay Guardian, 1971), 177-187.

Report”.³⁹ In the mid-1970s, from the pages of *Architecture in Australia*, the Melbourne based art critic Patrick McCaughey coined the term ‘Unarchitecture’.⁴⁰ McCaughey’s invective was accompanied by an explicit pictorial reference to the multi-storey commercial developments that prompted the demolition of many older historical buildings across Australia. The new buildings, for their absence of aesthetic values, were for McCaughey altogether unworthy of the definition of architecture.

The urban vernacular

If considered under the lens of the International Style, the modern skyscraper had an apparent problem of impossible reconciliation with the character of a place. This aspect was exploited as one of the most vulnerable points of modernity by the urban conservationists.

In the early 1980s, Ada Louise Huxtable tried to resolve this dilemma with a position of relativity about style. Her position endorsed, directly or indirectly, the path followed by a number of historical studies, which aimed at recovering the architectural heritage significance of post-war commercial architecture.⁴¹

Huxtable tracked the history of the skyscraper with an evolutionary stylistic periodisation of five stages. Within her trajectory, conceived as a continuation of Lewis Mumford’s “battle of styles”,⁴² she identified a phase of “true” and “uncorrupted” modernism which matured into the “Euclidian simplicity” of the post-war glass skyscrapers.⁴³ According to Huxtable, this phase, the third in her historical reconstruction, had evolved from Mies van der Rohe’s canon of “less is more” and it stood in antithesis against Mumford’s search for a new sense of “something more”. The first canon prevailed as a minimalist style that was fit for an historical period of economic boom and which was validated historically by “interesting parallels with the Chicago School”.⁴⁴

³⁹ National Trust of Australia (Victoria), *Collins Street Report: a Report by the Urban Conservation Committee of the National Trust of Australia (Victoria) on Suggested Planning Policies and Guidelines for Collins Street* (Melbourne: National Trust of Australia 1978).

⁴⁰ Patrick McCaughey, “Unarchitecture,” *Architecture in Australia* 65, no. 1 (January 1976): 44-47.

⁴¹ Ada Louise Huxtable, *The Tall Building Artistically Reconsidered: the Search for a Skyscraper Style* (Berkeley – Los Angeles: University of California Press, 1982).

⁴² Huxtable, 4.

⁴³ Huxtable, 56.

⁴⁴ Huxtable, 48.

This view on modernist – mostly glass-clad slabs - skyscrapers was in direct opposition to other critics, like Charles Jencks, who denounced the surrender to commercial architecture of the late Walter Gropius and Mies in America. Jencks described the attitude of the German masters as a “failure” and a compromise epitomised as the “politics of the apolitical”.⁴⁵ According to Huxtable, the American glass skyscraper of the 1950s was instead an underrated, popular and spontaneous architectural convention of its time:

I have never shared the view of critics who claim that the glass box is an icy curse visited upon us by the distortion of Mies “failed” vision. The failed vision is theirs. The Miesian skyscraper is the basis of a superb vernacular, probably the handsomest and most useful set of architectural conventions since the Georgian row house. To accept the vernacular of the suburban strip and reject the urban vernacular is ludicrous, particularly since this establishes a double standard (...)⁴⁶

For Huxtable, the modernist skyscraper, eventually reached a state of “terminal mediocrity” from the late 1960s onwards.⁴⁷ The critic indicated that what followed after, the age of postmodernism or “a freewheeling, unfettered and unapologetic pursuit of style”⁴⁸, was not immune to new faults and moral contradictions. Referring to a number of skyscrapers in Houston (commissioned by Gerald Hines and designed mostly by Johnson and Burgee), Huxtable remarked:

The developer (...) has found that rental response relates directly to a building’s recognition factor on the skyline. Identity and novelty give a builder a different product and a competitive edge. (...) But what is being sold is rarely architecture; it is a gimmick with a designer label. It is becoming a standard joke that some of the most dramatic details that suggest climatic views and spaces house mechanical equipment – an architectural put-on – of consummate cynicism.⁴⁹

Mirroring the critical reappraisal of Huxtable, Tony Styant-Browne in Australia reconstructed with a sequence of stylistic phases the “evolution” of the tall building in history and proposed parallels between Melbourne and the rest of the world.⁵⁰ Huxtable’s critique of the late modern office and postmodern building has parallels with more recent studies on the post war American office. According to James Russell, since the late 1970s, the architecture of American tall office buildings faded into the rise of the generic real

⁴⁵ Charles Jencks, *Modern Movements in Architecture* (New York: Garden City, 1973), 120.

⁴⁶ Huxtable, *The Tall Building Artistically Reconsidered*, 52.

⁴⁷ Huxtable, 62.

⁴⁸ Huxtable, 68.

⁴⁹ Huxtable, 68.

⁵⁰ Tony Styant-Browne, “The Tall Building: Evolution of the Type,” *Architect* [Victoria] (May 1988): 15-13; 28-32.

estate product in which “innovation withered” into “fad”.⁵¹ Along this line of thought, there is a prevailing historiographical trend that sees the earliest modernist skyscrapers - completed immediately after World War II - in a position of higher architectural significance.

The trend is reflected, for example, in Jennifer Taylor’s monographic milestone on the history of the tall modern office building in Australia. The period covered by the study (1945 – 1970) reflects the priorities of significance chosen by the editor. Parallels and local geographic differences are established with a general account on the evolution of business architecture in Australia. A regionalist responsiveness of the Australian early skyscrapers is evoked on the backdrop of the imported model of the American glass skyscraper, which is symbolised above all else by the Lever House in New York.⁵²

The vernacular interpretation re-emerges from the monographic study of Marika Neustupny on Melbourne’s early curtain walls. Melbourne’s modern façades in her study are seen from the point of view of place-making. Streetscape quality is generated by the proportional simplicity, the material variations and the compositional rhythms of the envelopes. Early modern architecture is connected and reinterpreted by Neustupny with post-modern eyes: priority of attention is given to the relatively smaller glazed and precast concrete façades of the 1950s, which are recovered as contributors of the streetscape rather than as landmarks, or creative destructors, of a city at large.⁵³

The speculative redemption

In 1978, the theme of the generic office building was revisited from a self-declared subjective point of view by Rem Koolhaas in *Delirious New York*.⁵⁴ The anecdotes surrounding the birth, life and, in some cases, obliteration of some tall building icons of New York were reconstructed by Koolhaas in a semi-fictional manifesto. Some of the central themes of *Delirious New York* resurfaced with a short essay written by the Dutch

⁵¹ James S. Russell, “Form Follows Fad: the Troubled Love Affair of Architectural Style and Management Ideal,” in *On the Job: Design and the American Office* edited by Donald Albrecht and Chrysanthé B. Broikos (New York: Princeton Architectural Press, 2000), 65.

⁵² Jennifer Taylor [ed.], *Tall Buildings: Australian Business Going Up: 1945-1970* (Sydney: Craftsman House, 2001).

⁵³ Marika Neustupny, *Curtain Call: Melbourne’s Mid-Century Curtain Walls* (Melbourne: RMIT Publishing Press, 2006).

⁵⁴ Rem Koolhaas, *Delirious New York: a Retroactive Manifesto for Manhattan* (New York: Monacelli Press, 1994 [1978]).

architect as a post-script in 1993, where he chanted the theme of “typical plan” as a design methodology aimed at justifying architectural design freedom.⁵⁵ The theme evolved as a form of opposition against the post-modern and hyper-regulated historical urban contexts of Europe at the end of the twentieth century. The typical plan, in his view, had the potential to redeem the architect from the moral constraints of uniqueness, which he saw as a consequence of the professional acceptance of architecture as a form of art. By contrast, Koolhaas found creative and rejuvenating possibilities in the repetitively extruded form of tall buildings that, although developed by technicians, seemed to gain unwillingly a new architectural meaning. Koolhaas pinned down some of the inherent formal characteristics of the relentless repetition of typical floors, among which the rectangular shape ruled above all others:

Typical Plan is an architecture of the rectangle; any other shape makes it atypical – even the square. It is the product of a (new) world where sites are made, not found. (...) Typical Plan is deep. It has evolved beyond the naive [sic] humanist assumption that contact with the exterior (...) is a necessary condition (...).⁵⁶

The favour of the Dutch architect for the “generic” and “deep” typical plans of New York was driven also by the appreciation of the “suprematist tension” of rectangular plans.⁵⁷ By contrast, the equally pervasive, but for Koolhaas more atypical, square footprints could not fit into the operative agenda to disrupt European post-modern contextualism.

Conflicting memories

There is a fundamental historiographical question that concerns the architectural image and the significance of many skyscrapers and office blocks of a certain age, particularly those built between the 1960s and the late 1970s. Can these modern monolithic tall buildings be considered as valuable and significant contributions to the development of architecture and the culture of their cities?

As past perpetrators of urban destruction, many tall office buildings of the 1960s and 1970s may be compromised by an original sin, which is not easy to redeem. Nonetheless, the question of preservation and longevity of tall buildings is now an item of relevance and

⁵⁵ Rem Koolhaas, “Typical Plan: Meditation, 1993,” in *Small, Medium, Large, Extra-Large* (New York: Monacelli Press, 1995) 334-350.

⁵⁶ Koolhaas, 338-339.

⁵⁷ Koolhaas, 339.

public discussion in Australia and Melbourne.⁵⁸ Many cities in the world may soon face the dilemma to choose between the permanence and the demolition of many tall structures built in the mid twentieth century, which, it is argued, are reaching the end of their life cycles.⁵⁹

The question of heritage significance of tall modern buildings has been raised in Australia since the late 1990s.⁶⁰ According to James Cowan, many older historical buildings of value were wrongly demolished in Australia after World War II. Then, a new mentality emerged towards the end of the twentieth century, which supported the conservation of mediocre buildings with poor economic value as “representative of their era”.⁶¹ According to Cowan, a change in the public mood supported conservationism in Australia from the 1960s. At first, it became the post-modern orthodoxy of the 1980s and then it “overshot the mark” with a blind excess of conservationism during the 1990s. Cowan added that buildings from an age when design taste was more restrained had the potential to survive better than those from a flamboyant era, but Australian heritage bureaucracies seemed to favour building conservation simply on grounds of age rather than on those of potential for re-use.⁶²

Cowan remarked also that the determinant for conservation in Australia was usually the quality of facade materials. Concrete with exposed aggregates, the prevailing building envelope finish of the 1960s and of the 1970s, has helped to create an image of deteriorating “shabbiness”, which has made many tall buildings of the era therefore unworthy of preservation.⁶³ Nonetheless, a discussion on the preservation of the State Office Block in Sydney (completed in 1967, demolished in 1997), which had a rare example of copper cladding, was an argument that could not be easily shared by the public. Cowan noted:

⁵⁸ Aisha Dow, “Melbourne's new wave of skyscrapers could survive ‘100 years’,” *The Age*, March 18, 2015, 3.

⁵⁹ Dario Trabucco and Paolo Fava, “Confronting the Question of Demolition or Renovation,” *CTBUH Journal* 4, no. 4 (2013): 38-43.

⁶⁰ James Cowan, “Should Tall Buildings be Preserved as Part of our Heritage?” *Architectural Science Review* 40, no. 2 (June 1997) 41-42. See also: “A Walk Past Some Representative Tall Buildings in Sydney,” *Architectural Science Review* 43, no. 3 (September 2000): 105-108.

⁶¹ Cowan, “Should Tall Buildings be Preserved as Part of our Heritage?” 41.

⁶² Cowan, 41.

⁶³ Cowan, 41.

The Heritage Council has never in the past accepted as an argument that a 19th century stone building should be replaced by a taller modern building because that was more economical for the owner of the land. So why this same argument should be accepted for the State Office Block, probably the best of the tall buildings [in Sydney] of the 1960s?⁶⁴

The irreconcilable attitude of antagonism of the general public towards late modernist monolithic architecture is reflected perhaps by the interest among contemporary theorists of architecture who aim to think, or “rethink”, beyond the dispute of modernity versus postmodernity.⁶⁵ For others, critical stances are still anchored to post-modern values for which the architecture of the “post-Miesian” towers is incompatible with contemporary morals of ecology.⁶⁶ For Peter Buchanan, the free-standing, monolithic air-conditioned buildings of the so called “oil-interval” of the 1960s were symptomatic of an anachronistic mentality on efficiency:

Such towers were efficient in the narrowest sense, maximising the ratio of net lettable to gross area and minimizing the area of the external envelope in relation to lettable floor. The quickness of their construction minimized building and interest costs but ignored long-term running costs, including those of energy consumption. Identical floors of minimal ceiling height were merely stacked for tenants to subdivide and fit out. Sealed off from the daily and seasonal cycles of the distant outside world, comfort was assumed to lie in stable conditions of mechanically tempered air and harsh fluorescent light. Architectural creativity was reduced to choosing an “off the shelf curtain wall” and the finishes in the lobby.⁶⁷

Following Buchanan’s logic, a valid argument for the preservation for these buildings is hard to build. As a consequence, Aurora Place, the newer, taller and more economically savvy skyscraper that replaced the older State Office Block in Sydney in 2002, was accepted by the critic as a positive model of city regeneration for “forging a relationship between city and sky” and for reconnecting visually the skyline of the business district with the sails of the Sydney Opera House.⁶⁸

Yet, demolition and substitution can hardly be a fix of general application for sites occupied by tall buildings. According to the skyscraper database of the CTBUH, there are no historical precedents of voluntary demolition of buildings that are taller than two-hundred metres. In Melbourne, where the tallest building ever to be demolished was less

⁶⁴ Cowan, 42.

⁶⁵ Steven A. Moore, “Technology, Place and the Nonmodern Thesis,” *Journal of Architectural Education* 54, no. 3 (February 2001): 130-139.

⁶⁶ Peter Buchanan, “The Tower: an Anachronism Awaiting Rebirth,” *Harvard Design Magazine* 26 (2007): 1-5.

⁶⁷ Buchanan, 2.

⁶⁸ Buchanan, 2.

than one hundred metres high,⁶⁹ the dilemma of permanence for a large family of buildings is now imperative, but the question of functional adaptability and cultural significance of tall buildings inherited from a non-flamboyant period – such as the 1960s and 1970s – seems less explored in contemporary debate.



Figure 1.11

State Office Block, Sydney (left), completed in 1968, was demolished in 1998 and replaced by Aurora Place in 2002 (right)

1.3 Technology, technocracy and environment

Does form follow function?

Aesthetic machines

The connection between modern skyscrapers and place is a terrain of contested debate and object of claims of architectural insignificance. By contrast, symptoms of technological impact in the architecture of tall buildings are more recognisable and accepted. Nonetheless, interpretations of the interaction between technology and tall buildings have varied considerably over time.

⁶⁹ The CRA Building in 95 Collins Street [Map 8C, 18], Melbourne, was demolished in 1987 for a cost of \$2,174,800. The building was 99 metres high. Public Record Office Victoria (PROV), City of Melbourne, Series VPRS 17299, Building Application Card Index 1916-1993, Demolition Permit no. D4773, 12 January 1987.

In 1900, New York-based architect Cass Gilbert wrote an article, *The Financial Importance of Rapid Building*, where the association of economic ends with technological means in the architecture of a tall office building was explained. Gilbert illustrated these techno-economic relations with the analogy of “a machine that makes the land pay”.⁷⁰ Gilbert’s definition was in antinomy to Sullivan’s more catching formula of the Chicago School that “form ever follows function”.⁷¹ The historian Sharon Irish, however, has indicated that Gilbert had a broader perspective than the aphorism may imply: the financial ends attained by the “machine” of fast-track building were part of a process aimed to acquire also a “measure of beauty” to attract tenants.⁷²

Yet, in spite of the traditional approach in the theory of modern architecture to focus on the relationship between technology and aesthetics, the broader association of tall buildings with the economic environment has often been ignored or remained at a subordinate level of interest in the work of historians. For example, interest in techno-aesthetics is epitomised by Siegfried Giedion in *Space, Time and Architecture*.⁷³ For Giedion, the Chicago School and the skyscrapers of Mies van der Rohe were symbolic of two moments in history where technology and aesthetics entered a rare state of symbiosis.⁷⁴ Mies and the Chicago School were the keystone arguments of the healing thesis of the “schism between construction and architecture, between the engineer and the architect”.⁷⁵

Giedion also saw the Rockefeller Centre in New York as a turning point of architectural development in the twentieth century. While the skyscrapers of New York were generally dismissed by the critic as degenerated “playboy architecture”,⁷⁶ Raymond Hood’s RCA Building was a noteworthy exception. It was, in fact, the pivotal and emblematic example of the thesis of space-time in urban design. For Giedion, the slab towers of the Rockefeller

⁷⁰ Cass Gilbert, “The Financial Importance of Rapid Building,” *Engineering Record* 41, (30 June 1900), cited in Sharon Irish, “A ‘Machine that Makes the Land Pay:’ the West Street Building in New York,” *Technology and Culture* 30, no. 2 (April 1989): 378.

⁷¹ Louis H. Sullivan, “The Tall Office Building Artistically Considered,” *Lippincott’s Magazine* 57, no. 3 (March 1896). Available at Hathi Trust Digital Library <http://babel.hathitrust.org/cgi/pt?id=mdp.39015022696051;view=1up;seq=1> (accessed 8 March 2013).

⁷² Cass Gilbert, “The Financial Importance of Rapid Building,” cited in Irish, 379.

⁷³ Sigfried Giedion, “Mies and the Integrity of Form,” in *Space, Time and Architecture* (Cambridge, MA: Harvard University Press, 1967), 587-617.

⁷⁴ Giedion, 607.

⁷⁵ Giedion, “The Chicago School,” in *Space, Time and Architecture*, 381-382.

⁷⁶ Giedion, “The New Scale in City Planning,” in *Space, Time and Architecture*, 846.

Centre were the symbolic opposite of the philosophy of the single-focus perspective of the Renaissance. The antithesis of the space-time concept in tall building architecture was the medieval skyline of the Italian cities - for example, San Gimignano in Tuscany - which Giedion exemplified with the pictures of the leaning towers of Asinelli and Garisenda in Bologna.⁷⁷

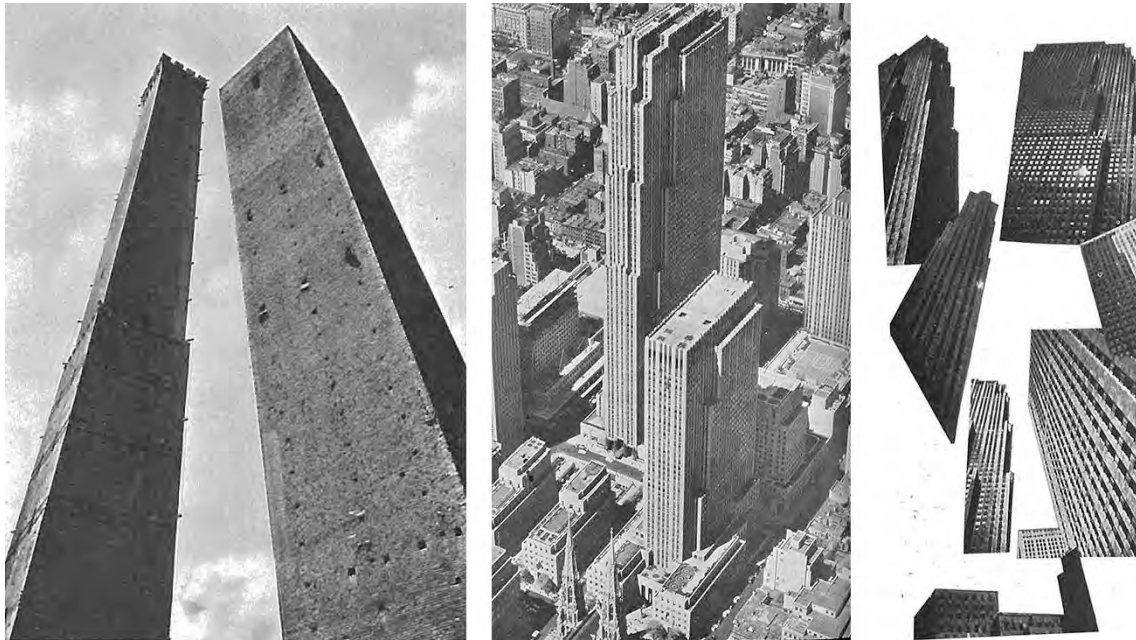


Figure 1.12

Tall buildings and Giedion's two conceptions of urban space represented in *Space, Time and Architecture*: the single point perspective of the leaning towers of Bologna (left) and the space-time of the Rockefeller Center in New York (right)

After World War II, Carl Condit reconstructed with a detailed monograph the lives of the architects, the buildings and the technical and aesthetic ideas of the Chicago School.⁷⁸ Condit followed Giedion in supporting the *connubium* between technology and aesthetics, and he enriched the account with historical accuracy on technical aspects. Nonetheless, Condit also felt that it was important to clarify that, despite Sullivan's motto, the School could not be reduced unilaterally to a utilitarian movement:

Function, structure and form are indissolubly welded. Applied science and technology provide it with materials and with their known mechanical, thermal and chemical properties; the artist's sense of form and order and harmony transforms them into emotionally satisfying objects that live in the imaginations of men while reflecting their ideals, aspirations, and

⁷⁷ Giedion, 850-852.

⁷⁸ Carl W. Condit, *The Rise of the Skyscraper* (Chicago: University of Chicago Press, 1952).

capacities. A genuine architecture is a technical-aesthetic synthesis which makes it possible for the world of industrial technology to [reach] the domain of feeling and morality.⁷⁹

In the 1970s, techno-aesthetic positions such as those held by Giedion and Condit lost critical appeal. American historian Winston Weisman proposed a new approach to recognise the cultural significance of skyscrapers, a “new view” that “would take into account both the influence of technology and the role of revival and more modern times”.⁸⁰ According to Weisman, technology alone was hardly valid to discern differences of form and style:

Advances in technology can, in large part, explain the growing height of the skyscraper up to about 1900 (...), but it cannot account for the dramatic changes that took place afterwards. New construction methods, such as bolted, riveted, then welded frames had virtually no effect on skyscraper appearance. Faster, smoother, and, finally, automatic elevators improved service but did not influence form. The electric light, better plumbing, more dependable heating systems and the telephone made life more comfortable and business easier to conduct, but these had virtually no effect on the shape of the structure.⁸¹

Technological influences on the form of tall buildings did not change after World War II, according to Weisman, despite the introduction of air conditioning and fluorescent lighting:

(...) where one could have expected a change in building form (...), we do not find this be the case to any great extent. Rather than encase the building in an opaque curtain to prevent the cool air from escaping to the outside and to control light, many architects and clients appear willing to suffer the resulting expense of leakage in favour of glass for the sake of appearance and the psychological effects on employee.⁸²

Banham's iceberg

Giedion's techno-aesthetic inquiry on architecture and society was expanded and disputed by Reyner Banham in the early 1960s. In an article reprinted in Australia in *Architecture Today*, Banham stated that the task of architectural critics is to engage with a multidisciplinary array of problems, where aesthetics could be considered only as “one seventh of an iceberg that shows above the water”.⁸³ The other six parts of the critic's job were to understand clients, construction resources, construction methods, place (including weather and politics), user needs, and, finally, building services.

⁷⁹ Condit, 3.

⁸⁰ Winston Weisman, “A New View of Skyscraper History,” in *The Rise of an American Architecture*, edited by Edgar Kaufmann (London: Pall Mall, 1970), 115-160, 118.

⁸¹ Weisman, 154.

⁸² Weisman, 154.

⁸³ Reyner Banham, “What Was That the Critic Said?” *Architecture Today* 4, no. 8 (June 1962): 14.

The interest in building services led Banham to discuss their implications in office buildings. He showed that a highly significant technological change affected architecture after World War II. New architectural developments were brought by the convergence of two innovations in particular: air conditioning and fluorescent lighting. Banham saw the synchronous maturation of these technologies as a focal moment in the history of modern architecture. Air conditioning and fluorescent tubes had allowed a “long overdue rationalisation” of the plan form of the tall office building.⁸⁴ Once building mechanical services reached the capacity to exercise full environmental control, they merged in the modern tall office buildings in the form of “concealed power”.⁸⁵

Notwithstanding Banham’s call for a broader need-to-be critique on tall buildings and the environment, his views on technology about modernist skyscrapers were still anchored to the iceberg tip of the aesthetics of the machine age. For Banham, the New York paradigms of the United Nations Headquarters and Lever House were two examples of the technological-artistic reconciliation where air conditioning was understood and rationalised in virtue of the *dicta* of a new aesthetic sensibility: the glass slab.

By the same token, Banham’s position was not sympathetic to large scale, air-conditioned and congested urban conglomerations. During a time of crisis and public scrutiny of the energy demands of air conditioning, he appealed to the environmental professions or, by his definition, the “environmentalists”, to reconsider in conscience the purpose of their technological work. In 1972, addressing an audience of mechanical engineers, Banham remarked that technological problems, such as those induced by the energy consumption of large buildings, still required technologists to resolve them:

(...) when we solve the environmental problem at one point, we dump the consequences and by products on some other point. This is not, as many well-meaning people seem to suppose, a necessary product of high technology. It is a consequence of any technology, high or low, that solves problems by isolating them from their context (...) The environmental nightmare can only be dispelled by the environmentalists [mechanical engineers, ed.], but the environmentalists aren’t being allowed to dispel it because of the paralysing effect of the nightmare. It may sound like an impasse but [it is] an invitation to come forward with a

⁸⁴ Reyner Banham, *The Architecture of the Well-Tempered Environment* (Chicago: Chicago University Press, 1969), 181-182.

⁸⁵ Banham, 195-233.

large, bold and humane gesture, a willingness to open the heart and the mind of the profession to the public.⁸⁶

Technocracy and the glass box

If Banham professed faith in technologists in the early 1970s, in the 1960s the Australian architect, lecturer and cartoonist George Molnar was already pointing the finger at “technocracy”, which, in his words, was “the management of a country by technical experts”.⁸⁷

For Molnar, technocracy was the fundamental cause behind the lack of humanity and architectural aspiration of skyscrapers, and office buildings in particular reflected the negative impact of technology in architecture. Skyscrapers were examples of “megalomaniac dullness”, “gigantism” and deliberate creation of “obsolescence”.⁸⁸ He added also that building prefabrication, standardisation and mass production were against freedom and individuality. Molnar concluded that “technocracy has no aesthetics” and that therefore “technocracy is an enemy of architecture”.⁸⁹ The tone of Molnar’s critique was akin to that of the orthodox urban conservation movements, although his views preceded those movements in Australia by a decade. But Molnar’s position was different from the conservationist stance. His target was the degeneration of technology into “technocracy”. It was a case of technological culture gone wrong, but not necessarily a problem of technology *per se*.

Australian architect and critic Robin Boyd shared a similar angle of criticism against technology. The “glass box, the international urban vernacular building of this century”,⁹⁰ was saluted initially by Boyd in the 1950s as a concrete hope to end what he desecrated as the fashion of “Featurism” in Australia. A few years later, Boyd’s critical slant on the International Style shifted towards disapproval. In the second half of the 1960s he warned of the undesirable side-effects that a blind-folded approach to technology could have for the profession of architecture:

⁸⁶ Reyner Banham, “The Well-Tempered Nightmare,” *Australian Refrigeration, Heating and Air Conditioning* 23, no. 3 (March 1972): 43–46.

⁸⁷ George Molnar, “Technocracy: the Enemy of Architecture?” *Architecture in Australia* 53, no. 4 (December 1964): 68–76.

⁸⁸ Molnar, 72.

⁸⁹ Molnar, 71.

⁹⁰ Robin Boyd, *The Australian Ugliness* (Melbourne: Cheshire, 1961), 107.

Once the glass box was popularly accepted (...) control of it passed from the architect's hands into those of the backroom boys of technology. There were a few seats in the back room for clever designers and stylists working alongside the technologists, polishing and perfecting the details of the glass cube, (...). But there was no seat in that room for the architect, let alone a throne. No scope for the architect's kind of exploration and invention was left in the glass box. He is not wanted now in the laboratories where its development continues, and he does not really want to be there. In the late fifties when this situation was emerging, the future of architecture was in some doubt. For a moment it looked as if architects had simplified their work to the point of having no job left.⁹¹

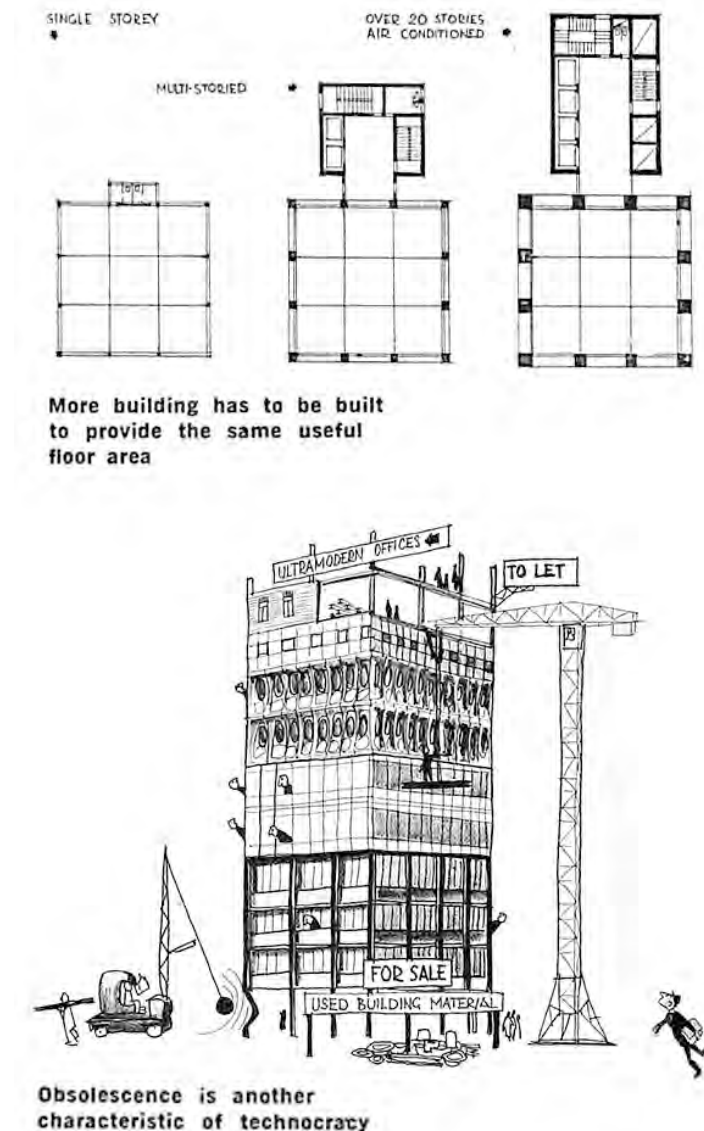


Figure 1.13

George Molnar's satirical critique of the tall modern office building

⁹¹ Robin Boyd, *The Puzzle of Architecture* (Melbourne: Melbourne University Press, 1965), 16.

Other Australian commentators were not radically opposed to the question of technology. Historian John Maxwell Freeland shared a sense of negative criticism towards the tall building, but only for the “glass box”, which in 1968 he described as already obsolete for the commercial building industry of the times. The sudden phasing out of these early curtain wall office blocks in Australia was welcomed by Freeland:

(...) the glass boxes were as much fashion buildings as any other Australian buildings have ever been and were less sensible – expensive, unfunctional [sic] and, in the main, unspeakably dull. On the whole they were bland, characterless cellophane packages which, paying no heed to either the problems or the virtues of the Australian climate, proclaimed the naïve conviction that in a world of shrinking dimensions, technology had obliterated all regional distinctions as well.⁹²

The reasons to overhaul the glass box were not socio-aesthetic. Freeland noted how early curtain walls in Australia demonstrated inadequate technological performance. He specified problems of glass failures, weather leakage, scarce durability and inadequate climatic response, which were combined with the unreliability of the early air conditioning systems. For these reasons, Freeland indicated two tall office buildings in Sydney, the IBM Centre and the Water Board Building, as more fitting examples of Australian commercial architecture of the late 1960s. The merits of the square plan tower of the IBM Centre were recognised in particular for their tectonic quality and urban sensibility:

To protect its bands of glass window the architects incorporated pre-cast concrete hoods bent downwards at an angle of forty-five degrees. Stacked eighteen storeys high, the tiers of sloping hoods resulted in a most dramatic pagoda silhouette. But more important than its visual drama was its sheer sensibleness. It was a bold, simple and direct answer and, unlike any of the earlier attempts, was perfectly in scale with both the building and the city skyline of which it was a commanding part. (...) The IBM was a sensible answer to the problem of the glass box. While others, still staunchly following the fashions despite a rising chorus of professional and lay criticism, continued to erect them (...).⁹³

While Molnar and Boyd saw the political control of technology by specialists, or technocracy, as a problem, Freeland's critique of the curtain wall in Australia, once the specific problems of place were acknowledged, saw technology as a valid avenue to reach sensible architectural solutions. The two positions may appear divergent. Yet, once unvarnished from the judgmental values on aesthetics, they share a common denominator:

⁹² John M. Freeland, *Architecture in Australia: a History* (Melbourne: Cheshire, 1974), 298.

⁹³ Freeland, 301-302.

the fundamental incidence of technological problems in the architecture of modern commercial buildings.



Figure 1.14
Stephenson and Turner, IBM Centre, Sydney, 1962-64

The skyscraper environment

More recently, Thomas Leslie has shown that the word environment, when associated with commercial architecture, already existed in the vocabulary of the architects of the Chicago School.⁹⁴ The word, however, had a connotation that is rather different to the one with which it is associated today. Leslie states that Dankmar Adler, responding to and expanding upon Sullivan's formula of 'form follows function', wished to amend – or ameliorate with clarity - the theory of his business partner. Adler introduced the notion that the form of a building should be determined by mediation with site surroundings, or, in his words, with the "environment" that surrounds the building. For Adler, who was also a

⁹⁴ Thomas Leslie, "Dankmar Adler's Response to Louis Sullivan's 'The Tall Office Building Artistically Considered,' Architecture and the "Four Causes'," *Journal of Architectural Education* 64, no. 1 (September 2010): 83-93.

practising mechanical engineer, the word environment did not communicate merely about climate control: it extended to the economic and technical milieu in which the project took place. Leslie sees this as a Darwin-inspired concept which, in Adler's mind, could potentially lead to the production of a wide diversity of species (styles) in architecture. Ultimately, Adler and Sullivan possessed a broad perspective on aesthetic values and these values went beyond the restrictive logic that form is a product of function.⁹⁵

One could argue that these architects operated within a regional environment, where economics, architecture and industrial product innovation were interconnected through a volatile state of technological evolution. Leslie's recent studies on Chicago have gone a step further to demonstrate this. As one example of such interconnectedness, there is evidence of the relationship between the stylistic responsiveness of the School and the introduction of two key technological innovations: incandescent lamps and plate glass.⁹⁶

These and other recent studies of the skyscrapers of Chicago,⁹⁷ offer useful methodological prompts and suggest that an investigation of the architecture of tall buildings can be reconciled with an approach that goes beyond the traditional axiomatic logics according to which form must follow something else. To see architecture as an autonomous discipline with a formal agenda would be reductive. But it would be equally reductive to consider architectural design as a discipline that limits its formal outcome as the practice of "following" inputs by others. As Leslie has reasoned, architecture is interwoven with the multifaceted cultural ideas of a society but also with the techno-economic environment - not only its speculative-economic one - which permeates a specific time and place. It seems that architects of the late nineteenth century in Chicago, who are traditionally considered as the inventors of the modern tall office building, understood this well. And this was equally understood by Cass Gilbert, who explained that the "machine" for rapid building had to be reconnected, by necessity, also to an aesthetic measure to attract tenants.

⁹⁵ Leslie noted that the Darwinian theory of evolution was source of inspiration for another architect of the Chicago School, John Wellborn Root. According to Root, in architecture, older forms are destroyed by new ideas and "aspects of life". "Vagaries of fashion and temporary fancies should have no influence" said Root in "A Great Architectural Problem," *Inland Architect and News Record* 15 (June 1890): 66-71.

⁹⁶ Thomas Leslie, "Glass and Light: the Influence of Interior Illumination on the Chicago School," *Journal of Architectural Education* 58, no. 1 (September 2004): 13-23.

⁹⁷ Thomas Leslie, *Chicago Skyscrapers* (Champaign, IL: University of Illinois Press, 2013).

The paradox of the three F's

It is plausible to accept that there are three categories of use, or functional destination, with which the form of tall buildings is explained as the effect of other agents. In the historiography of skyscrapers, form has been reduced to a result of 'function' (e.g. Sullivan and some technologists), 'finance' (Willis and the economists) or 'fashion' (Huxtable and the stylists). This may seem a simplified interpretation, but these three categories can serve to establish a dialectic that calls for a multi-causal approach to explain the formal dynamics of tall buildings.

The three 'F's' represent broader, deeper and more articulated concepts, which have been given by different authors in the context of several purposes of enquiry. The concept of function for Sullivan, for example, was one that did not imply mere functionalism. It was a pragmatic approach to a compositional problem, which Sullivan envisaged to resolve with a tripartite vertical zoning. As the title of the famous article clarified better than the famous axiom, function was the aim to reconcile form and destination of use with the scope to reveal an artistic truth.⁹⁸

As Carol Willis recognised, the axiom "form follows function" was not the more apt formula to describe the early skyscrapers of New York and Chicago. The author would have rather summarised her seminal study with the label of "vernaculars of capitalism".⁹⁹ The strength of Willis' milestone contribution to the history of skyscrapers and architecture was indeed to highlight the interaction between economy and place in a specific urban and temporal setting.

The words fad and fashion have been used perhaps less favourably in association to skyscrapers than style. Here, fashion is used to summarise an established tradition of historical studies, which considered tall buildings mostly for political-operative criticism or in evolutionary terms of style.¹⁰⁰ Style is, in extreme synthesis, a variable that can depend largely, like fashion, upon the subjectivity of people, place and time.

⁹⁸ Louis Sullivan, "The Tall Office Building Artistically Considered".

⁹⁹ Willis, *Form Follows Function*, 7.

¹⁰⁰ Henry-Russell Hitchcock, "The Architecture of Bureaucracy and the Architecture of Genius," *Architectural Review* 101 (January 1947); Paul Goldberger, *The Skyscraper* (New York: Knopf, 1981); Thomas Van Leeuwen, *The Skyward Trend of Thought: the Metaphysics of the American Skyscraper* (Cambridge, MA.: MIT Press, 1988); Charles Jencks, "Wrestling with Mega-Build," in *Post-Modernism: the*

Within the boundaries of architectural aesthetics, the explanation of form as a product of fashion becomes an oxymoron, since a subjective and pluralist variable seems difficult to be reduced to the deterministic outcome to follow something else. Form cannot be explained convincingly by this axiom, because it becomes relative, subjective and undetermined. However, form and architectural style, as considered for example by Huxtable, can be described dynamically through time.

The only possible explanation of fashion as the causal agent of form in office buildings would be to consider it in the most reductive sense of marketing makeup to attract tenants, as a “measure of beauty”,¹⁰¹ or as a “designer label”.¹⁰² Within this reading, however, fashion would fall into the functionalist realm of the financial means aimed at securing rentability through architectural image.

The causal agent of ‘finance’ is recognised by Willis in the form of speculative formulas, which are imposed by the functional destination of the building as a rentable space for business. Alternatively, some corporate owners may connect the form of the building to its functional need as a long-term investment. Real estate formulas are then measures to assure productivity either by attracting tenants who are willing to pay a price to use a space or by securing built capital value to attract, in prospect, future purchasers. Thus, finance can also be logically brought back to a matter of function: if the building is a form of investment, then it can be argued that its function is to appeal as a productive business to a potential market demand of occupiers, and/or to secure future returns with property transactions.

There is a fundamental limitation, however, in any of these causal interpretations of form. A relationship of simple causality prevents understanding the building in a more accurate, complete and useful sense. It seems that the interpretation of form as an effect of another cause is logically sound, but only if the form is considered as a result of “function”. In the specific case of a tall office building, “finance” and “fad” can ultimately be considered as a sub-category of a broader concept of architectural function.

New Classicism in Art and Architecture (London: Academy 1987); Gail Fenske, “A Brief History of the Twentieth Century Skyscraper, in David Parker and Antony Wood [eds.], *The Tall Buildings Reference Book*, (London-New York Chicago: Routledge - Council on Tall Buildings and Urban Habitat, 2013).

¹⁰¹ Irish, “A ‘Machine that Makes the Land Pay’,” 378.

¹⁰² Huxtable, *The Tall Building Artistically Reconsidered*, 68.

Summary

The architecture of skyscrapers lends itself to differences and variations of analysis, judgment and scope of historical enquiry. Therefore, to understand the form of these buildings, it is pertinent to straddle several areas of inquiry. However, to consider the axioms of the three 'F's (e.g. 'finance', 'fashion' and 'function') as three separate strands of investigation would hardly lead to a coherent methodological model. Considering the object of this study, and given the apparent formal homogeneity of the towers and slabs of the second half of the twentieth century (e.g. 'box architecture') the risk of oversimplifying or reaching contradictory results with such a method is high. The three questions of whether the form of tall office buildings derives from finance (economy), fashion (aesthetics or subjectiveness of time and place) and function (in a technical sense of fruition) can only remain rhetorical. Such problems cannot be answered simplistically because the three approaches are methodologically incompatible with one another.

There is nonetheless an inherent relevance of the three aspects of economics, style and technological functionality in the form of tall buildings; but to take such relevance as the sum of three univocal logics of causation would be an oversimplification; to postulate that the form of tall buildings may 'follow' something else would ultimately result in an axiomatic vision of architecture as an utilitarian discipline.

Therefore, reconnecting with the initial questions of this chapter, and in order to respond if and how the form and quality of a building type – and/or the skill of designers and character of a place - can be related to one another, it is preferable to shift the problem from logical axiomatic statements into the analysis of interrelated causes and effects. Questions, rather than being formulated in logical terms, should be unravelled in teleological terms, or in other words, in the context of an Adlerian environment where forms, functions, materials and human agents coexist, interact and assist one another.¹⁰³

Given the need to embrace such a broad range of influences, Schumpeter's theory of the *Economic Development*, with the corollary of creative destruction, offers a valuable bridge between technology and economics, where none of the two components prevails or 'follows' as the effect of the other. To choose the Schumpeterian model as an analytical

¹⁰³ Leslie, "Dankmar Adler's Response to Louis Sullivan's 'The Tall Office Building Artistically Considered'," 90-92.

instrument of the built environment implies to assume that the theory is valid beyond the field of economics. This assumption can be taken safely on the basis that cross-disciplinary studies have already stemmed in this sense. Schumpeter's economic model of the business cycle was used before in studies of history of technology and theories of innovation, such as Nathan Rosenberg's analogy of the "black box", which refers to the critical value of technology for explaining theories and historical processes of innovation.¹⁰⁴ Furthermore the process of creative destruction is compatible with, and partially derived from,¹⁰⁵ Abbott Payson Usher's reading of the processes of innovation as a sequence of small steps, yet able to converge in strategic moments of "cumulative synthesis", which Usher observed in the process of mechanical inventions.¹⁰⁶

Schumpeterian economics alone, however, may not suffice to give in-depth explanations for studies that are immediately beneficial for building owners, planners, architects, builders, technologists and other stakeholders involved in tall building developments. In other words, the process of creative destruction is valuable to explain how techno-economic business development may have occurred broadly over time; but economic theories alone are not sufficient to explain why a specific building form, typology or pattern of modification may have prevailed more than others over time and in a particular urban setting.

This limitation should not be mistaken as a sign of incompatibility of Schumpeter's theory with other disciplines. To the contrary, the need for explaining economics beyond economics alone and engaging in the analysis of processes of change related to products and technology is essential to the ideas of Schumpeter:

(...) even if we had the means of measuring the change in the technological efficiency of industrial products, this measure would still fail to convey an adequate idea of what it means for the dignity or intensity or pleasantness of human life – for all that the economists of an earlier generation subsumed under the heading of Satisfaction of Wants. And this, after all, is for us the relevant consideration, the true "output" of capitalist production, the reason why we are interested in the index of production and the pounds and gallons that enter into it and would hardly be worth while in themselves.¹⁰⁷

¹⁰⁴ Nathan Rosenberg, *Inside the Black Box: Technology and Economics* (Cambridge, UK: Cambridge University Press, 1982), 5-6.

¹⁰⁵ Schumpeter, *Business Cycles*, 85.

¹⁰⁶ Abbott Payson Usher, *A History of Mechanical Inventions* (New York: Dover, 1982 [1954]), 68-69.

¹⁰⁷ Schumpeter, *Capitalism, Socialism and Democracy*, 66-67.

The use of Schumpeter's theory for architecture and construction history is, in summary, instrumental, and aimed to define the basis of a humanist methodology of research. The value of Schumpeter's lesson is that it can describe economic activities dynamically and in an evolutionary sense, and yet within a framework that is able to explain also radical changes and events of sudden development, destruction, and downturn.

Moving forward, the next step required is to define a research methodology that, fitting with this Schumpeterian assumption, can be applied to describe phenomena of the built environment. This methodology should be able to explain an architectural typology that - at first sight - seems more a "formally invariant" phenomenon than a revolutionary one.¹⁰⁸ The explanation of a phenomenon of this kind must therefore look inside what Italian architect and critic Aldo Rossi referred to as the "architecture of the city"¹⁰⁹ and inside the architectural equivalent of what historian Nathan Rosenberg's has defined as the "black box" in studies of history of economics and technology.¹¹⁰

¹⁰⁸ Manfredo Tafuri, *Theories and History of Architecture* (London – New York: Granada, 1980), 158.

¹⁰⁹ Aldo Rossi, *L'architettura della città* (Milano: Città Studi, 1980 [1966]), 9-10.

¹¹⁰ Nathan Rosenberg, "The Historiography of Technical Progress," in *Inside the Black Box: Technology and Economics* (Cambridge, UK: Cambridge University Press, 1982), 3-33.

Chapter 2

Skyscrapers and the four causes

Operative notes for a techno-economic critique of tall office buildings

Remember, a given object may have all four causes: in a house, for instance, the efficient cause is the architectural skill of the designer; the final cause, the completed work as conceived by him; the material cause, bricks and mortar; and the formal cause, its definition.

Aristotle¹

In April 1959, *Architectural Record* reviewed four office buildings designed by Skidmore Owings and Merrill (SOM): the Crown Zellerbach Headquarters in San Francisco, the Norton Building in Seattle, the John Hancock Western Home Office Building in San Francisco and the Shell Head Office Building in Melbourne.² All four buildings were designed by the San Francisco branch of SOM.

The four projects faced similar briefing problems: the “building’s economy – the amount and kind of usable area (...), flexibility (...) office space, and (...) functional operation.”³ All four projects required owner occupation, but had to adapt to demands of different corporations. The journal illustrated how diversity was achieved by handling the same means in design: structure, core, building module and services.

Although these buildings were in three different cities and two different continents, the article did not dwell significantly on influences from site conditions. The four projects were nonetheless diverse for architectural technology and typology. Floor plan shapes varied: two buildings were rectangular with aspect ratio of 1 to 3, one rectangular with aspect ratio of 2 to 3, and one was a perfect square. Three buildings had a side core, one of which external, and the fourth had a central core. All four buildings had steel skeletons, but with differences in the methods of assembly, modules, member sizes and spans.

¹ *Metaphysics*, Book B, Chapter II. English translation by John Warrington: *Aristotle’s Metaphysics* (London – New York: Dent – Putton, 1956), 89-90.

² “Four Office Buildings: Four Different Schemes,” *Architectural Record* 125, no. 4 (April 1959): 163-174.

³ “Four Office Buildings: Four Different Schemes,” 163.

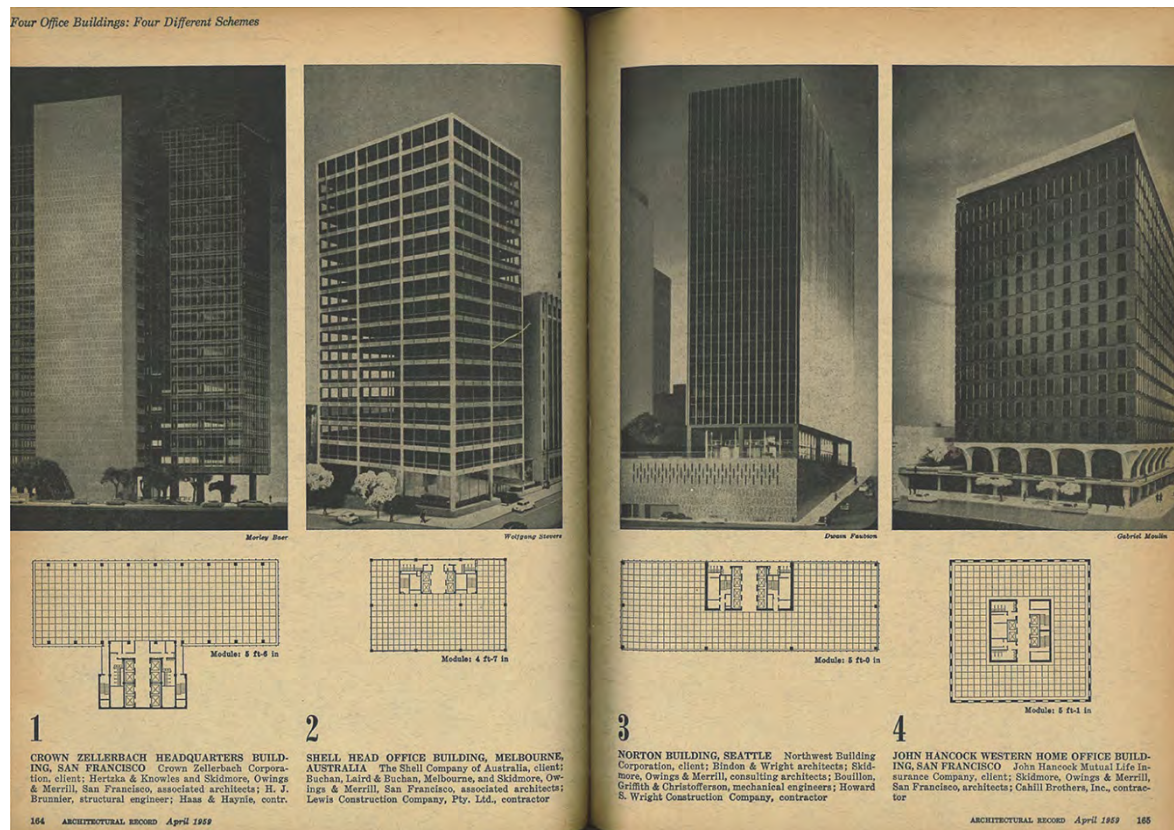


Figure 2.1

Four office buildings designed by Skidmore Owings Merrill San Francisco presented in *Architectural Record*, April 1959; from left to right: Crown Zellerbach Headquarters, San Francisco; Shell Headquarters, Melbourne; Norton Building, Seattle and John Hancock Western Home Office, San Francisco

Problems of building economy were resolved with different construction methods, although all schemes had to allow flexibility of space in operation. While all sharing the monolithic aesthetic approach of the box, the four projects showed a wealth of design parameters (proportions, location of services, structural and façade materials and patterns) that were used differently to achieve a range of variations on the theme.

These four owner-occupied office buildings, all designed by the same firm, suggest that extra-architectural influences, such as those induced by speculation, may not suffice to explain in depth purist architectural forms as a simple result of economic imperatives. Speculative intent may not have been foreign to the design of these owner-occupied buildings. Yet, the imperatives dictated by economic functionality were resolved with subtle, but not irrelevant, typological and technological variations. These variations are

visible for observers prepared to look beyond the generic monolithic appearance of boxes of glass and metal. In these four office buildings, type and technology were governed by the configuration of core and structure, a modular approach to design and by the reticulation of building services. These subtle variations become evident to an observer able to dissect and understand the fundamental elements of the typology in question (e.g. site location, disposition of the core, shape and proportions of the floor plate, modularity, provision or absence of open space, et cetera). Similar considerations can be given on building materials and systems - which may also affect space configurations - and on how these technologies were handled differently from project to project; for example, the focus could consider the location of air conditioning systems, the relationship between columns and fenestration and so forth.

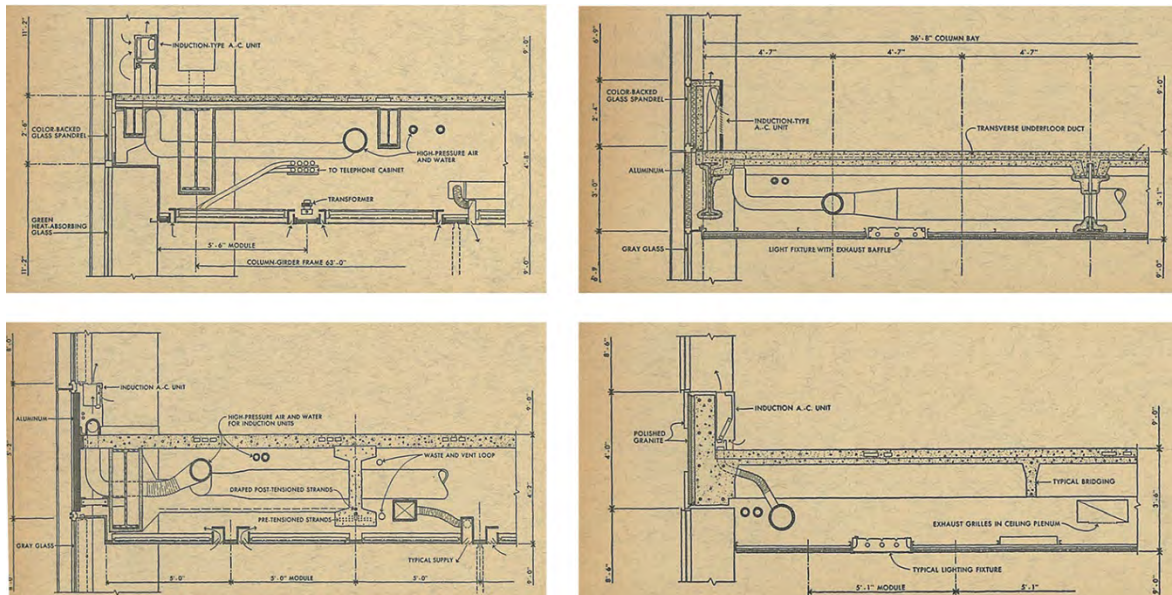


Figure 2.2

Skidmore Owings Merrill, typical floor-wall junctions of Crown Zellerbach, San Francisco (top left), Shell, Melbourne (top right), Norton, Seattle (bottom left) and John Hancock Western, San Francisco (bottom right)

Notwithstanding differences, these four office buildings still belong to a certain family or typology of buildings, which in order to be compared must share a common “code” or “language” of interpretation of architecture designed to meet a business purpose.⁴ It is also

⁴ Umberto Eco, “La Funzione e il Segno: Semiologia dell’Architettura,” in *La Struttura Assente* (Milano: Bompiani, 1968), 189-249.

possible, notwithstanding the variations on the theme, to recognise in these buildings a shared design approach and *ethos* to multi-storey office buildings of a certain period of time, which, in this case, appears to transcend localisms, cross the Pacific and reach Australia from North America. But, even if these four buildings were designed by the same firm, the four schemes had significant differences of form and technology that must have been generated by inputs from different employees, clients and urban contexts.

Given that one of these buildings was located in Melbourne, this example is fitting to introduce the discussion on what research methodology is appropriate to analyse the tall office buildings of the city in the second half of the twentieth century. This methodology would benefit, first of all, to be immune to pejorative aesthetic assumptions that could be induced by the apparent homogeneity of form of the buildings in question. Secondly, as identified at the end of Chapter 1, at the core of the problem there is the need to find a set of determinants, or ‘causes’ in an Aristotelian sense, which can explain also subtle formal differences and variations of architectural quality over time. Moreover, having assumed the Schumpeterian model as a valid proposition to analyse the built environment, these causes must be able to embrace matters of economics and technology with equal priority.

But before coming to terms with the core of this problem, it is important to define unequivocally the terminology to be used in the discussion. Some clarifications are required on terms that, if left generic, could be easily misunderstood: ‘speculation’, ‘architectural quality’, ‘architectural form’, ‘place’ and ‘technology’.

2.1 The architecture of the city business

Speculation, architectural quality and form

Building speculation

In English language there are two meanings associated with the word ‘speculation’. The first definition relates to “the forming of a theory or conjecture without firm evidence”; the second definition relates to the economic activity of “investing in stock, property [...] in the hope of gain but with the risk of losses”.⁵ The origin of the word comes from the Latin

⁵ *Oxford Dictionary of English*, 2nd edition, s.v. “speculation”.

verb *specere*, which means “to look at”, “to view”, “to observe”. In Ancient times and through the Middle-ages ‘speculation’ maintained the connotation of “intelligent contemplation, consideration; act of looking” and of “pursuit of the truth by means of thinking”; in the 1500s, the word shifted meaning towards “conjecture” and, from the late 1700s, there is evidence of speculation meant in the economic sense of “buying and selling in search of profit from rise and fall of market value”.⁶

Today, the adjective ‘speculative’ has a twofold meaning. It qualifies for thinking activities of intellectual conjecture and for engaging in the act of investing money with considerable risk. As an example of the second meaning, there is the term “speculative builder”, which is defined as the kind of developer who engages in construction activity “without securing buyers in advance”.⁷

As discussed in Chapter 1, influences of an economic nature can be assumed as a *conditio sine qua non* for the architecture of tall office buildings. This postulation is assumed from the destination of use in these buildings, whose finality is either that to be a productive support of business operations or to create wealth through rental of space to others. Within this general assumption, a neat distinction arises from the first instance, when the design of a tall office building may be commissioned for owner-occupation, and the second instance, when a building may be speculative, or in other words built with the principal aim of producing income. These two instances are neatly defined in theory, but seldom translated into architectural examples that consider them as opposites.

On the one hand, it is common that an owner-occupied tall office building allocates for rental a portion of its space. On the other hand, it is imperative that a building conceived only for rental fulfils functional expectations that make it flexible to adapt to different models of operation and, therefore, easier to let. This need can be summarised with the word rentability, which indicates the good potential to convert built space into rented space that generates income. Therefore, the speculative attribute of tall office buildings consists in the presence of a degree of rental uncertainty, which may vary in respect to different places and different buildings.

⁶ “Online Etymology Dictionary,” s.v. “speculation”. <http://www.etymonline.com/> [accessed 18 April 2015].

⁷ *Oxford Dictionary of English*, s.v. “speculation”.

Moreover, the variable of speculation is related to time. In financial markets, a long-term investment may allow taking a higher level of risk, while a shorter-term investment outlook may suggest taking less risk. By contrast, the variable of time in office building projects has a moderating influence on risk. In real estate, spreading the return over a long term period lowers the chance of losses. So, a commitment from an anchor tenant to rent premises for a longer period of time lowers the level of risk and justifies an investment outlook that seeks long-lasting building value and a lower return per annum. By contrast, a short time commitment from a tenant may drive the owner of the building to seek a higher return in a shorter time.

In summary, the attribute 'speculative' can be considered as a variable that is always present in an office building project, but that becomes dominant when the project is conceived with a high level of uncertainty. A highly speculative approach, for example, would consist of engaging in construction activity before securing anchor tenants in advance or, *in extremis*, to capitalise immediately soon after the completion of the project by selling the property.

A common aspect of the act of speculating, in both senses of the meaning, is to create a conjecture, whether intellectually or economically. Tall office building development, at any rate, is a high-risk and undetermined economic activity. Building speculation, therefore, is not an exact science and is open to entrepreneurial error by definition. It is due to this inherent level of uncertainty that the conception of tall office buildings is firmly tied to preliminary economic assessments, known as feasibility studies, which respond to general laws and methods and allow predicting, quantifying and mitigating the level of risk in a building project.

Cost versus value

In 1962, the Australian Institute of the Quantity Surveyors (AIQS) began to publish quarterly its official journal, *The Building Economist*. Through the content of a number of articles published in the journal during the 1960s and 1970s, it is possible to reconstruct historically the principal methods that were used to determine the feasibility of large commercial projects in Melbourne and in other Australian cities.

In Australia, after World War II, there were sophisticated methods and practices to carry out feasibility studies for tall office building projects. But before and soon after the war, these methods were rather simple. One approach consisted in the method of adjusting the balance between building cost and the earning power of a building. This basic method would maximise the profit of a speculative operation either by minimising cost or by increasing the earning capacity of the project through variations of rental price.⁸

From the mid-1960s onwards, a new approach to feasibility emerged, which based decision-making on the qualitative assessment of “value”, rather than on the quantitative implementation of profit by cost-cutting or price-raising.⁹ The trigger of this change was the realisation that some projects could benefit from earning more income if they possessed a certain “market image” that was able to attract tenants prepared to pay more for rent.¹⁰

In 1966, Australian building economist George Duncan discussed this method in relation to large speculative projects.¹¹ Duncan explained the concept of value as a monetary expression of the “architectural quality” of a building or, in other words, as an exercise of “assessment in relative worth”.¹² A commercial building should satisfy a functional efficiency that complies with a minimum standard of use. At the same time, the building should possess something else, an “aesthetic content”, which makes the building “a desirable or enjoyable thing to use”.¹³ Duncan concluded that “differences in monetary value correspond to differences of architectural quality”.¹⁴

The key element that connected an economic benefit to architecture was the concept of efficiency: “for a given level of architectural quality there must be a single corresponding

⁸ Christopher C. Hallett, “Value in Cost Control,” *Building Economist* 19, no. 3 (December 1980): 135. This traditional and older method is discussed with reference to H. A. Babcock, “Architecture and Building Economics,” *Architectural Forum* 48, no. 1 (May 1930): 739. Another American source, cited by Hallett to explain the transition from profit-making to value-making, is “Value Analysis: Total Project Cost Perspective,” *Architectural Record* 157, no. 3 (March 1975): 69-70.

⁹ Hallett, 135.

¹⁰ Hallett, 135.

¹¹ George P. Duncan, “Elements of Theory and Practice,” *Building Economist* 5, no. 1 (May 1966): 2-6.

¹² Duncan, 3.

¹³ Duncan, 3.

¹⁴ Duncan, 3.

cost such that any reduction in that cost will induce a reduction in quality”.¹⁵ Duncan’s concept of efficiency was illustrated graphically with the law of the diminishing returns. The law was governed by the principle that increments or decrements in cost would “have a larger effect on value when the cost is low rather than when the cost is high.”¹⁶

$$V = F \times \mathcal{A}E$$

V = Value = Architectural quality

f = Functional efficiency

$\mathcal{A}E$ = Factor for aesthetic content

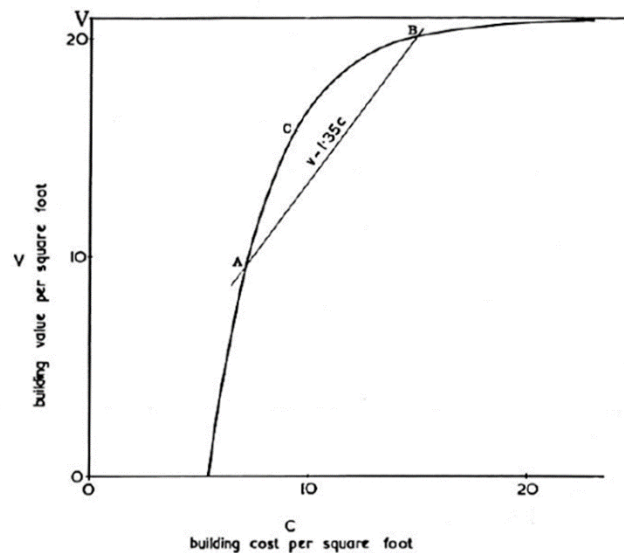


Figure 2.3

George Duncan’s definition of value as “architectural quality” and curve of diminishing return between building value and building cost based on data from Australian city office buildings, 1966

Duncan’s theory of the relationship of cost to value was based empirically on a survey of city office buildings in Australia.¹⁷ The theory was connected to the feasibility method of the “residual method of land valuation”.¹⁸ In another paper, the same economist described graphically the method with a nomogram that mapped in nine steps the sequence of factors to be considered in the feasibility of a project in inner city centres.¹⁹ The steps were

¹⁵ Duncan, 5.

¹⁶ Duncan, 5.

¹⁷ Duncan, 5.

¹⁸ Bernard Williams, “Information Sheet Economics 1: the Residual Method of Land Valuation,” *Architect’s Journal* 157, no. 20 (May 16, 1973): 1209.

¹⁹ George P. Duncan, “Building Economics: Central Area Sites,” paper presented at the Pan Pacific Congress of Real Estate Valuers and Appraisers’, April 1969. The paper’s content and nomogram are reproduced in Daryl Le Grew, “Central business district redevelopment: development and design criteria for large scale commercial and business centres,” (thesis, undergraduate, University of Melbourne, Faculty of Architecture, Building and Planning, 1972).

connected in a sequential process of cause and effect chained in this order: (1) net income as given by net lettable area, (2) percentage of net to gross area, (3) net income according to gross building area, (4) years required for purchase, (5) capital value of gross building area, (6) building cost and expenses, (7) excess of capital value over building cost, (8) number of floors covering the site, (9) site cost and expenses.

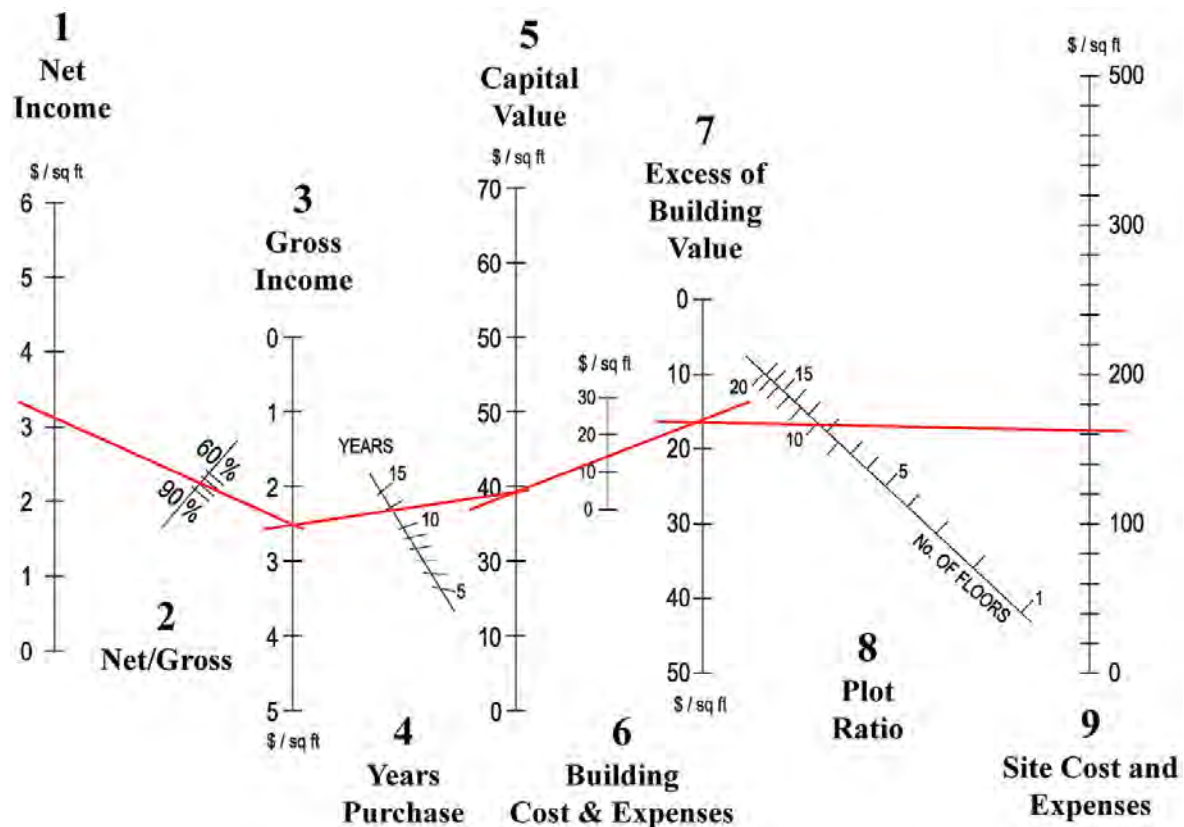


Figure 2.4

George Duncan, feasibility nomogram for city office building development, 1969

Time values: short versus long term

In the late 1960s, the residual method of land valuation was indeed a diffused technique of assessment used at the onset of office building projects in Melbourne,²⁰ but other methods of economic forecast were also used. Through the 1960s and 1970s, two alternatives to the residual method of valuation were the “simple rate of return” and the “discounted cash

²⁰ Michael Martin, Robert Peck et al., “A general background to building development,” in “Office block design: office block thesis report,” (thesis, undergraduate, University of Melbourne, Faculty of Architecture, Building and Planning 1967).

flow analysis”.²¹ The first method consisted in taking an estimated rate of return representative of the entire life of an investment. The second method consisted of a sophisticated analysis that calculated the net present value of an investment by considering in detail all the future incomes and all the future expenses of the building.

Since the 1960s, the discounted cash flow method was extensively known and used in Australia to assess the purchase of equipment and machinery and for residential building developments.²² Some limitations of the method existed due to the difficulty in making accurate assumptions of all future elements of cost; others derived from the complexity of the calculations that were required. In the 1960s, and until the diffusion of computers in the 1980s, the discounted cash flow method remained appropriate for small scale developments or for short term investments, which were largely reliant on financial credit rather than on large investments of liquidity.²³ Some key benefits of the system consisted in the opportunity to “take a series of investment proposals that [could] compete for the funds available and rank them in order for profitability”.²⁴

The method of the simple rate of return, notwithstanding its high level of approximation, was instead the most used method of feasibility used in Melbourne for large city office buildings. A CSIRO study completed in 1979 concluded that the method had been widely used in Melbourne in the 1960s and 1970s. The study found that several local developments had shown a reliable level of “reasonable approximation” confirmed by “real returns” of large city projects.²⁵ The method was well-accepted locally because of economic conditions with high inflation and a steep growth in land values, which lasted until the late 1970s. The CSIRO study concluded that the aptness of the simple rate of return was symptomatic of the local developer’s approach to consider the “long term nature of investment in buildings”.²⁶

²¹ S. N. Tucker, “Economic Assessment Criteria for Building Investment,” *Building Economist* 17, no. 4, (March 1979): 156-162.

²² M. G. Wright, “Discounted Cash Flow Technique,” *Building Economist* 8, no. 1 (May 1969): 6-9.

²³ Tucker, 161.

²⁴ Wright, 7.

²⁵ Tucker, 161.

²⁶ Tucker, 162.

A long-term perspective seemed to be the prevailing attitude in office building investment in Australia since the late 1960s. In 1967, A. L. Comport discussed the role of real estate agents in the design of office buildings in Australia, emphasising, as done earlier by Duncan, the centrality of the concept of value in cost control:

In short some economy is false economy. Just as some expenditure is wasted in whole or part. There is a critical point in design standard and finish where cost produces maximum value.²⁷

Comport advocated that, in an office building, real estate experts were the ones capable of finding the right balance between cost and value through their knowledge and experience of local market conditions. He explained that, at least for Australia at that time, “long-term rentability”²⁸ was the ultimate goal of the investment operation:

Whatever the developer wants and whatever the architect wants, must be subjugated to what the tenant wants long term. In any investment the comfort and satisfaction of the rent payers is of prime importance. They are the geese that lay the golden eggs.²⁹

Speculation and the city

Speculation, therefore, can be described as a variable entity, although of constant presence in office building projects, that is ultimately tied to an element of risk to be projected in time. Although undetermined by definition, a speculative enterprise can be simulated by a set of feasibility laws, which can be used to mitigate the level of uncertainty. Feasibility studies, as approached in Australia after World War II, consisted in the hypothetical determination of a future outcome, through an exercise of estimation of value at the beginning of the project. These assessments projected in the future an expected economic result in function of time, quality of location and – not secondarily - the architectural quality of the building.

Notwithstanding the omnipresence of the speculative attribute in such buildings, feasibility methods of the second half of the twentieth century were influenced by a multiplicity of factors, which included quality of lettable space, construction methods and architectural aesthetics. All this suggests that the configuration of a tall office building, also in virtue of

²⁷ A. L. Comport, “The Role of a Real Property Consultant in the Erection of a New Office Building,” *Building Economist* 6, no. 1 (May 1967): 7.

²⁸ Comport, 7.

²⁹ Comport, 7.

the real estate agent's *telos* to 'lay the golden eggs', could hardly be reduced to a one-way problem of financial causation of cost-cutting and profit maximising.

On another scale of intervention, it seems that the interaction of speculation with the form, or the architecture of the city district at large, would be even harder to explain through the lens of financial determinism. With this in mind, Italian architect and critic Aldo Rossi suggested that it was possible to establish some laws that pertain to the activity of speculation in a city. These laws, however, would be merely a set of economic formulas or methods of general application set to quantify risk in monetary terms and in respect to a particular project, time and place. By themselves, Rossi claimed, the laws would not be enough to understand the dynamics and interactions of the multiple forces that act to determine the "architecture" of a city.³⁰ The influences, or better still the interactions, of speculation with the form of multiple built artefacts, may be described, but it may harder to generalise and connect such influences to a general urban theory:

If we study the nature of economic speculation (...) we can probably establish some laws. (...) But if we try to establish why the application of these forces produces effects which are so different on the structure of the city, it is more difficult to give an answer.³¹

Rossi therefore proposed a methodological approach to analyse speculation in a city, which does not aim to discover what the laws are *per se*, but that aims to establish: (1) how the economic forces are applied to the 'architecture of the city' and (2) how the application of these economic forces can change in relation to time and place. The goal, according to Rossi, becomes the establishment of a "relationship" between these forces by unravelling the "modality of the transformations".³²

It can be assumed that there is a set of speculative laws that may govern the feasibility of tall building projects, which are destined for occupancy by rental – if not *in toto*, at least in

³⁰ Aldo Rossi, *L'architettura della città* (Milano: Città Studi, 1980), 194-195.

³¹ Rossi, 194. In Italian: "Se noi studiamo ad esempio la natura della speculazione, intesa come manifestazione di certe leggi economiche, possiamo probabilmente stabilire alcune leggi che le sono proprie; queste caratteristiche saranno però probabilmente di natura generale. Se noi però cerchiamo di indagare il perchè l'applicazione di queste forze produca effetti tanto diversi sulla struttura della città, ci è più difficile dare una risposta."

³² Rossi, 195.

part. The pertinent question, however, is to establish how these forces may have acted and reacted in relation to a family of buildings in a particular time and place.

Having framed the discussion in the terms above, it is critical that the aim of the enquiry should be to describe how the general speculative laws of feasibility may have interacted with the architectural forms of single buildings and how the architecture of these buildings can be contextualised in broader urban transformations. So, given a sufficiently long period of time, it becomes easier and more meaningful to describe how these forms and transformations of the city may have changed over time.

Form and *oggetti principali*

A further clarification is now required concerning the word ‘form’, which in relation to architecture may be exposed to much ambiguity. The meaning of the term can be limited to superficial aesthetics, and, in some instances, form and architecture may be shallowly forced to coincide with one another. The question of formality in modern tall buildings may appear an inconclusive and tautological quest since the form, in this case, is often a ‘monolithic’ box: a Euclidean regular prism where morphology may seem paralysed and frozen to its zero degree. In reality, this view could only stem from an approach that limits the definition of form to that of superficial aesthetics. The discussion on form, therefore, needs to be addressed in different terms.

At an elementary level, built form can be described along the lines of Francesco Milizia’s definition of the three principal objects of typology, the *oggetti principali*.³³ (1) *situazione*, or location; (2) *forma*,³⁴ or shape; and (3) *distribuzione*, or distribution of the parts. This typological notion stems from the classicist assumption that architecture belongs to a compositional palette of basic geometric shapes, but for Milizia, this idea of typology pertained to the design of ‘any’ building (*qualunque edificio*). These objects are rules of universal character (*regole universali*) in respect to time, place and destination of use, and for Milizia’s these rules are the pillars of the notion of *comodità* - a concept derived from Leon Battista Alberti’s meaning of *commoditas*.

³³ Francesco Milizia, *Principi di Architettura Civile*, Bassano-Venezia: Remondini 1795, Tomo Secondo, Libro Primo, 9.

³⁴ The Italian word *forma* in Milizia’s text refers to the building shape in plan. Milizia breaks down this planar geometric connotation of *forma* as circular, rectilinear and hybrid shapes.

Transposing from the theory of typology to the family of modern tall office buildings, the *oggetti principali* of this particular building type can be identified as: (1) the relationship that the building establishes with the site, including orientation, scale and compliance with urban design regulations; (2) the shape and size of the floor plate and – if any exist - the geometrical variations of the floor shape along the height of the building; (3) the centralised location of ancillary spaces, in other words the service core, the position of these in respect to the floor plate and the distribution of services, to be considered both horizontally in each typical floor plate and vertically in the entire building.

2.2 Speculating on architectural quality

Two conjectures about Melbourne's tall buildings

The black box

It may be argued that a meaningful discussion on buildings for business does not need to involve considerations on technology and that an explanation of form along the lines of real estate economics and physical influences of a certain environment may suffice. This approach is certainly possible and valid, since it is somehow necessary to consider economics as a self-evident factor, which is implicit in the definition of tall office buildings as a form of business. However, this approach has also a significant limitation.

By discussing the dynamics between architecture and a certain, specific and limited socio-economic environment, it is possible to describe, explain, and even re-assess culturally, a localised phenomenon for a period of high historical significance. For instance, the early American skyscrapers of New York and Chicago were described and explained in this sense by Carol Willis in *Form Follows Finance*.³⁵ Nonetheless, this method of urban-economic description of tall buildings could hardly address the bulk of problems associated with the international context of modern skyscrapers.

The limitation of the *Form Follows Finance* approach is due to differences of scope and to the peculiarity of the period that is analysed here. Melbourne's modern tall office buildings belong to a relatively recent period in time, which, according to recent and contemporary

³⁵ Carol Willis, *Form Follows Finance: Skyscrapers and Skylines in New York and Chicago* (New York: Princeton Architectural Press, 1995).

perceptions, has doubtful cultural significance of wide-spread reach among the general public. Further, the object of study is an international phenomenon that cannot be strictly confined to the dynamics of one or two cities alone. And furthermore, it is a phenomenon set in a time that was subject to considerable – and arguably radical - technological changes. For these reasons, it is essential to enlarge the front of investigation from the dyad of economy and place to a triad that includes also the third realm of technology.

Economic historian Nathan Rosenberg warned against a diffused scholar attitude to consider technology as a discipline imprisoned inside an hermetically isolated container, a “black box”³⁶ at the mercy of the more general and pervasive rules of economy:

The great bulk of the writing by economists on the subject of technical change - both theoretical and empirical - treats the phenomenon as if it were solely cost-reducing in nature, that is, as if one could exhaust everything of significance about technical change in terms of the increases in output per unit of input that flow from it. It is a useful simplification that makes it possible to analyze a wide range of problems with a relatively simple analytical apparatus (...). At the same time, however, to ignore product innovation and qualitative improvements in products, is to ignore what may very well have been the most important long-term contribution of technical progress to human welfare.³⁷

Transferring this standpoint from economics to urban and architectural studies, by treating economic stances as a matter of prevalence in the form of buildings, important aspects that concern technological change may remain overlooked or left aside. By the same token, it should not be inferred without evidence that technology may have been the ultimate and logical cause behind a phase of “terminal mediocrity” of the late modern skyscraper.³⁸ It seems more pertinent that a discourse on technology about tall buildings should be treated as a problem of higher significance and articulation. Paraphrasing Schumpeter and Rosenberg’s metaphor of the black box, to leave technology out of modern tall office buildings would be like “to play Hamlet without the Prince”.³⁹

³⁶ Nathan Rosenberg, *Inside the Black Box: Technology and Economics* (Cambridge, UK: Cambridge University Press, 1982).

³⁷ Rosenberg, 3-4.

³⁸ Ada Louise Huxtable, *The Tall Building Artistically Reconsidered: the Search for a Skyscraper Style* (Berkeley – Los Angeles: University of California Press, 1982), 62.

³⁹ Rosenberg, 4.

Technology and place

If the terms speculation, quality and form may be easily misinterpreted, words such as 'place' and 'technology' can be open to an even broader spectrum of misunderstandings. In relation to architecture and building construction, technology may be reduced to the minimum terms of techniques of assembly of building materials. Within this narrow outlook, the scope is limited to the domain of building systems, components, tools and products. But there are more sophisticated methods of research that are available, and that, at the same time, do not exclude material problems from a discussion on place.

Recently, a broader definition of technology in relation to the built environment has been presented by Steven Moore.⁴⁰ In this view, technology is considered with a tripartite definition that is not narrowly focused on the study of objects, but inclusive of human knowledge and activities. This definition of technology includes: (1) knowledge to create artefacts with the ability to relate them to a natural environment, (2) human activities, patterns, institutions and problem solving and, finally, (3) the objects, the tools, which would be otherwise useless without the items at (1) and (2).

Moore's threefold meaning of technology attempts to reconcile the poles of technology and place, which generally are put in antagonist terms of value, respectively, by modern and postmodern thinking. In parallel to the notion of technology, Moore proposed a tripartite notion of place as a multi-layered field that includes: (1) a location, which is a transnational area subject to a defined political economy; (2) a sense of place, which is a subjective feeling of the character in place; (3) a locale, or a "mesoscale" between (1) and (2), which is an institutional realm where architecture should take place.⁴¹

Although originated from a contemporary debate stemmed from environmental concerns, this approach towards technology and place can serve, potentially, as a tool for retrospective studies - and not only as a manifesto for the "non-modern" future of architecture, which Moore contemplates.⁴² These tripartite notions, if applied in a historical sense, would free research paths from worsening axioms on the influence of technology,

⁴⁰ Steven Moore, "Technology, Place and the Nonmodern Thesis," *Journal of Architectural Education* 54, no. 3 (February 2001): 130-139.

⁴¹ Moore, 131.

⁴² Moore, 135.

particularly in studies of construction history focused on the international phase of modernism. If this mode of thinking could be extended into the past and adopted as a *modus operandi* for present critiques, then any enquiry into the relationship between architecture and technology would be liberated – at least at the origin of a discussion – from any pejorative assumption. In this multi-faceted mode of thinking about place and technology, it would be contradictory to assume *a priori* that some periods in history may have been marred by context-blind and technocratic buildings assembled by off-the-shelf components. This, arguably, suggests the existence of a paradox in Moore's operational scheme, which is aimed to eradicate, irrelevant of connotations given by prefixes, any left-over modern interpretation of the built environment.

These considerations about place and technology would seem, however, forced into a retrospective application, which was not explicitly contemplated by Moore. Yet the tripartite notion of place, which Moore borrowed from John Agnew,⁴³ suggests in principle that transnational influences do exist and can flourish in technology and architecture. So, if to leave technology out of the discussion of international skyscraper would be unthinkable, to consider the value of this typology only according to the metre of a micro-local sense of place would be an inconsistent and paralysing assumption for the object of this study.

Two hypotheses

In summary, tall office buildings are influenced by a variable degree of speculation. This type of building is the product of a human activity that makes economic conjectures by investing large sums of capital with a high level of risk. Consequently, the concept of a tall office building, before becoming reality, has to be tested against methods of economic assessment that seek to confirm rentability prospects. The potential success of the operation is also dependent upon quality and location of the land in a given economic and urban environment. Traditionally, this environment coincides with the city, meant specifically as the central business core of larger metropolitan area (for example, Manhattan in New York, the Loop in Chicago or the Hoddle Grid in Melbourne).

⁴³ John Agnew, *Place and Politics* (Boston: Allen and Unwin, 1987), 62.

From the 1960s onwards, the methods of feasibility that were used more frequently in Melbourne required a detailed understanding of local building costs and rental markets. Decision-making in this context was taken by assessing local factors, such as cost of materials, cost of labour, pre-existing rental conditions, land values, land taxation, market demand for particular size and kind of office space, efficient ratios of lettable space and ancillary spaces and regulations controlling density and height in relation to size and location of land. Essays written by Australian quantity surveyors and real estate consultants during the 1960s and 1970s confirm that feasibility studies aimed to maximise “architectural quality” through efficiency or, in other words, long-lasting built value.⁴⁴ They explain also that in Melbourne, from the early 1960s, there was a common approach of mitigation against risk and inflationary trends, which preferred to speculate with tall office buildings as a form of long-term investment.

Therefore, notwithstanding the all-important input of building economics in commercial architecture, a group of tall office buildings can be described according to qualitative terms of architecture. This kind of description is possible once the term architectural quality is defined as a building that has good ability to attract tenants or, in other words, good rentability. This component of quality is the product of an added value, which is defined as a “factor of aesthetic content”, to basic functional efficiency.⁴⁵ Having considered all this, it is then possible to define a first hypothesis, which in synthesis can be stated as follows:

- In the second half of the twentieth century, Melbourne’s skyscrapers were conceived with an inherent level of speculation that varied according to prospects of rentability. These prospects were determined by rules of economic feasibility and a perception of market value transmitted by architectural quality.

Moreover, the definition of place that should be adopted for studies on international skyscrapers cannot be grounded locally, but extended to a multi-level field of international exchange, which, in the specific case of this study, deals with the city of Melbourne. To

⁴⁴ S. N. Tucker, “Office Development Projects: What Determines Economic Feasibility?” *Building Economist* 13, no. 2 (September 1974): 75-82.

⁴⁵ Duncan, “Elements of Theory and Practice,” 3.

use the term *milieu*, in the etymological sense of “middle-place”,⁴⁶ is more pertinent to describe place in this sense. The *milieu* denotes a mesoscale of interaction, which may have originated, like the building typology that is analysed, from cultural and technological affinities with North America. The *milieu* in question is not limited by the socio-aesthetic locale of the city of Melbourne; it is something that contains international techno-economic endeavours that bridge Australia and the United States of America.

The *milieu* of Melbourne’s tall buildings is thus a transnational area of architectural influence (most likely open to other parts of the world too). The existence of these influences is confirmed, *prima facie*, by the foursome of American-designed buildings presented at the opening of this chapter. The consideration of such influences leads to a second hypothesis. This assumption is linked with the elementary definition of tall buildings – or skyscrapers – given in the Chapter 1, which defines them in relationship with a specific urban context and as a building typology of technological specialisation. In synthesis, the second hypothesis can be stated as follows:

- In the second half of the twentieth century, Melbourne’s skyscrapers were conceived and built in response to materials, forms and human activities that pertained to a technological *milieu* that was affected by influences from the United States of America.

In summary, two hypotheses that pertain, in general terms, to the form of tall office buildings are established: the first is centred on the economic dynamics of the city; the second is centred on transnational technological influences. These two assumptions derive from the postulation given at the end of Chapter 1, which adopts the process of creative destruction of Joseph Schumpeter as a theoretical superstructure. Within this theory, a phenomenon of the built environment like skyscrapers can be explained (in a techno-economic sense) in conjunction with cyclic economic fluctuations. There are two fundamental aspects of this theory that are noteworthy in terms of methodology: (1) Schumpeter’s model is evolutionary and apt to use retrospective studies over relatively

⁴⁶ *Milieu* derives from French words *mi* (middle) and *lieu* (place). Online Etymology Dictionary, s.v. “*milieu*”, <http://www.etymonline.com/> [accessed 22 April 2015].

long periods of time; (2) the model is based on a qualitative basis that implies to look beyond economic conditions alone.⁴⁷

The first of these two points imposes to define the domain of the retrospective investigation with specific coordinates of place and time. Keeping in mind the need to refer such coordinates, of which particulars are given in Appendix A, the second point leads to the definition of the methods of enquiry that are appropriate for the limitations of time and place selected in this study.

2.3 Searching for the four causes of skyscrapers

Some questions concerning Melbourne and its techno-economic milieu

The four causes

The multi-level notions of place and technology discussed so far suggest that architectural technology should intersect the realm of human activities. Compatibly with this position, there is an even more universal conceptualisation of technology that can be used instrumentally to break down, unfold and manage narratively the interactions of economy, place and technology in the built environment. This conceptualisation can assist to give explanations of problems and phenomena such as tall buildings, which are dominated by a techno-economic component of human activities.

Martin Heidegger conceptualised technology as a human activity with the scope to pose means to an end. Borrowing from the tradition of Aristotelian metaphysics,⁴⁸ the German philosopher elucidated the concept of technology with a four-fold structure of causation that is relevant for the modern age. In short, Heidegger explained that the technological essence of an artefact can be described - and understood - as the result of four interconnected causes: (1) a material cause (*causa materialis*) which is the material - or objective matter - from which an artefact is made; (2) a formal cause (*causa formalis*) which is the form into which the material(s) enters to take definition; (3) an efficient cause

⁴⁷ Joseph A. Schumpeter, "The Circular Flow of Economic Life as Conditioned by Given Circumstances," in *The Theory of Economic Development: an Enquiry into Profits, Capital, Credit, Interest, and the Business Cycle* (London – New Brunswick, NJ: Transaction: 1983 [1934]), 3-56.

⁴⁸ Martin Heidegger, "The Question Concerning Technology, 1954," in *Readings in the Philosophy of Technology*, edited by David M. Kaplan (Lanham: Rowman and Littlefield, 2009), 9-24.

(*causa efficiens*), which represents the agents or makers of the artefact who bring it towards its intended end use; (4) a final cause (*causa finalis*), which is the end purpose for which an artefact is made.⁴⁹

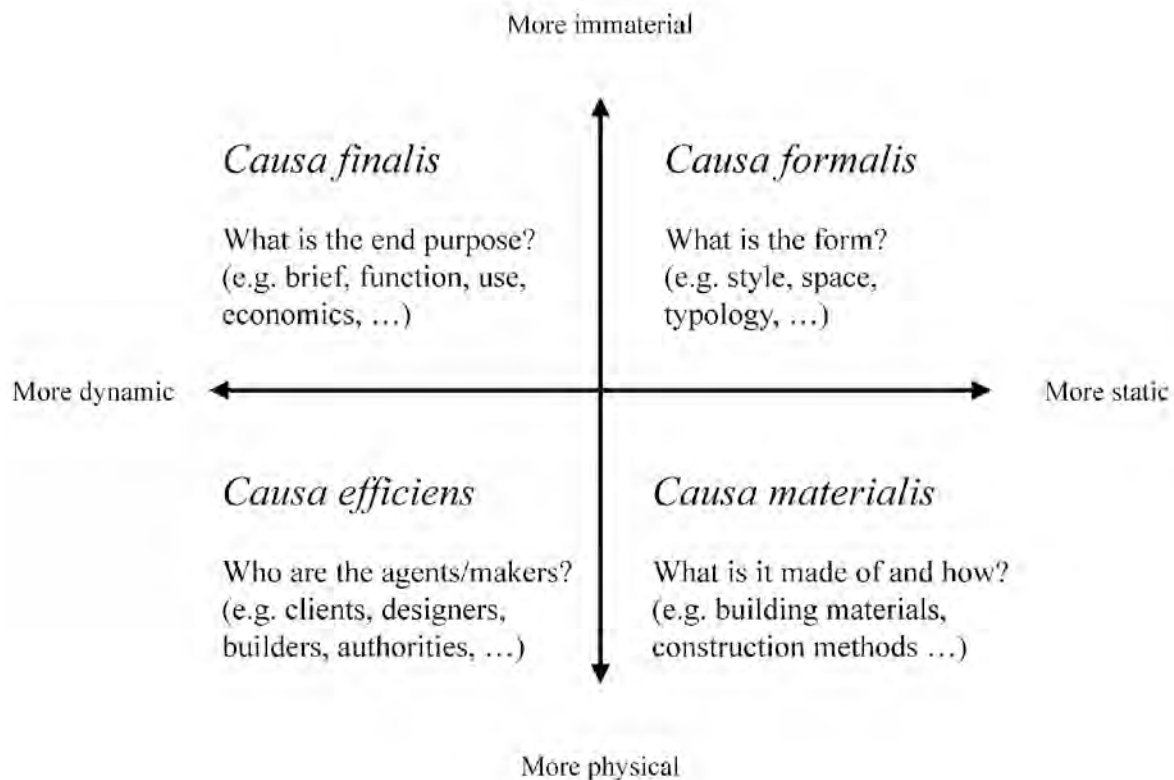


Figure 2.5

The Aristotelian scheme of four-fold causation

According to Heidegger, the four causes are mutually interrelated and do not imply a sequential order of causation from one to the other. This interrelation denotes that technology is ultimately a human activity that interacts with – but does not follow as an effect of – a pre-existing socio-technical environment of materials, forms and end purposes. The efficient cause, the agent or maker, is vital to generate the artefact. The agent, however, does not follow as an effect of the materiality of the artefact. At the same time, the agent does not make artefacts *ex nihilo*, but must source materials as they are

⁴⁹ The example of artefact given by Heidegger was a silver chalice. The material cause of the chalice is metal silver. The formal cause is the cup-shape configuration that allows to drink from it and recognise it as an object apt for drinking. The efficient cause is the silversmith. The final cause is the religious ritual.

available in a given environment. The agent may actualise purpose through materials and form, but must refer to pre-existing knowledge of conventional forms and work to meet a community-shared understanding of the end purpose for which the object is made.

The original Aristotelian theory of causation does not imply, however, an open structure.⁵⁰ There are two binomial relationships that split the foursome of the causes conceptually in half. On the one side, the *causa materialis* and the *causa formalis* have a primary ontological significance of “immanence” and these causes are therefore fundamental for ontological explanations on the substance or “essence” of things; these causes are more meaningful for “static” explanations of the physical world. On the other side, the *causa efficiens* and the *causa finalis* are fundamental for teleological explanations about purposes and change of things; these two causes are in this sense more “dynamic” than the other two.⁵¹ At the same time, a distinction could be made in another sense, between causes with a higher degree of physical nature (efficient and material cause) and causes with a higher degree of immaterial nature (formal and final causes). From an operative perspective, however, the distinctions between static and dynamic, and between physical and immaterial causes, should not be taken literally or in absolute terms, but rather as a comparative term of emphasis and differentiation between different sets of causes.

The lesson of Heidegger on technology is, in any case, important in studies on modernity for suggesting that technology, as a human activity, can be revelatory of truth. Investigations on technology can be instrumental to bring awareness of the unreasonable demands of modernity upon nature (such as those, for example, of an apparently irrational period of frantic and oversupplying building activity in a city). In other words, technological understanding has the potential to actualise truthful and meaningful answers to general questions such as: ‘why is this like that?’ Alternatively, if devoid of the four-

⁵⁰ In Aristotle’s metaphysics the formal cause has a superior ontological significance, because it can correspond, more closely than others, with the pure “essence” or “substance” of things. The final and the efficient cause can also – in some instances – surge to the level of ontological primacy; but in Aristotelian metaphysics, the material cause has in all cases a subordinate role, because it is not able – unless combined with form – to convey any meaningful essence/substance about things. Exception is made, though, for “bare matter”, which is intrinsic to all materials. See *Metaphysics*, Book Z, Chapter XVII, *passim*.

⁵¹ Giovanni Reale, *Storia della Filosofia Antica: Platone e Aristotele* (Milano: Università Cattolica, 1975), 267-269.

fold Aristotelian structure of causation, technological enquiries may stay stranded to mono-causal, open-ended and subjective responses such as ‘because this follows that.’

Keeping this scheme of multi-fold causality in mind, architectural form cannot be dealt with as an entity that follows as the effect of other causes. Form is one of four causes, and the one that – in line with Aristotle - can explain more than others the definition – in other words, the essential substance - of a building, which is a technological artefact made by human beings with given materials and in view of a particular *telos*, or final purpose.

By transposing these philosophical concepts into the field of research in architecture and construction technology,⁵² the four modalities of causation can be used instrumentally to frame a problem through a set of questions. A phenomenon of built-form, which deals with this method of enquiry, can lead ultimately to answer why the architecture of a building, or of a group of buildings, may have taken particular modalities of genesis, change and disappearance in respect to a particular time and a particular place. In this way, technology, meant as an array of causes related to artefacts, can explain the essence of the built-environment. It can provide an explanation about the “modality of the transformations” of building types in a city through interconnected processes of material processes, formal conception, human activity and functional purpose.⁵³

Skyscrapers and the four causes

At this point, having given the necessary definitions, and having introduced the Aristotelian ‘four causes’ as a general method of enquiry into the essence and reasons of artefacts, it is possible to summarise how this operative framework can be applied to investigate and discuss the architecture of tall office buildings.

Using the four causes as a starting point, a research on the architecture of skyscrapers could depart in several directions. For example, one could analyse the relationship between forms and materials in tall buildings; another could concentrate on efficient and final

⁵² The transposition of this concept of causation for the architecture of tall buildings is borrowed from Thomas Leslie, “Dankmar Adler’s Response to Louis Sullivan’s ‘The Tall Office Building Artistically Considered’: Architecture and the ‘Four Causes,’” *Journal of Architectural Education* 64, no. 1 (September 2010), 91.

⁵³ Rossi, *L’architettura della città*, 195.

causes, for example, by analysing the role of designers vis-à-vis how space varies according to destination of use (See figure 2.6). Following these vertical axes, there is a risk to operate with a skewed perspective which is either ‘static’ or ‘dynamic’.

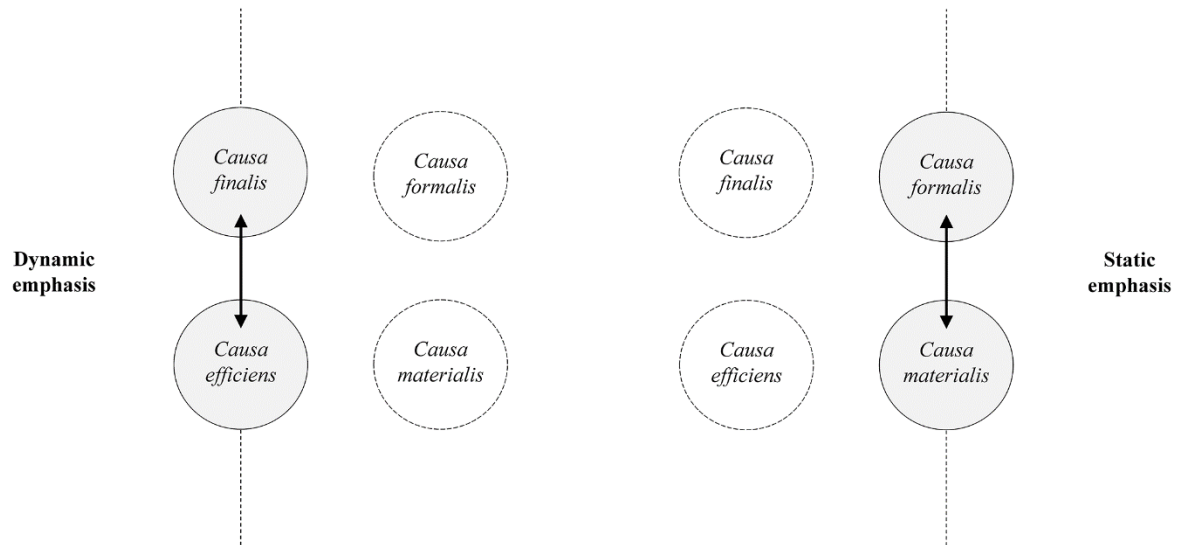


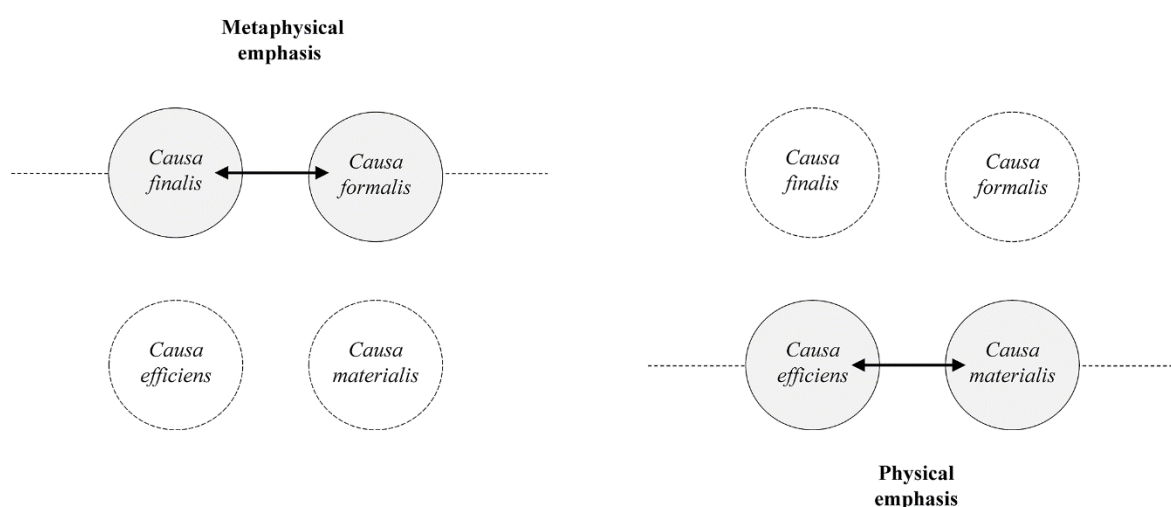
Figure 2.6

The four causes: dynamic versus static emphasis

For example, Reyner Banham’s reading of the modern office building in *The Architecture of the Well-Tempered Environment* is eminently dynamic, in the sense that emphasises the functional side of architectural technology (e.g. air conditioning and fluorescent lighting), but the narrative is made through examples given by the masters of modernism (e.g. United Nations Headquarters and Lever House, New York).⁵⁴ Winston Weisman’s *New View of Skyscraper History* is eminently static in the initial premise that conceives a method of research for tracking “phases” over long periods of time to explain technology alongside form and style, from the historical revivals of the origins of the typology until post-modern times.⁵⁵

⁵⁴ Reyner Banham, “The Environment of the Machine Aesthetic,” in *The Architecture of the Well-Tempered Environment* (Chicago: Chicago University Press, 1969), 122-142.

⁵⁵ Winston Weisman, “A New View of Skyscraper History,” in *The Rise of an American Architecture*, edited by Edgar Kaufmann (London: Pall Mall, 1970), 118-119.

**Figure 2.7**

The four causes: metaphysical versus physical emphasis

Another approach could follow one of the two horizontal axes illustrated in Figure 2.7. One would focus on the physical evidence of material and efficient causes (e.g. tall building designers and building techniques), putting formal and final causes in second place. Conversely, the opposite approach would operate on a level concerned mostly with formal and final causes (e.g. tall building typology and functions), with efficient and material causes in second place. Broadly speaking, two classic examples of this horizontal approach are those of Carl Condit⁵⁶ and Carol Willis.⁵⁷ According to this scheme, the influential work of the two historians is more ‘physical’ in the case of Condit (emphasis on individual designers and construction systems) and more ‘immaterial’ in the case of Willis (more emphasis on spatial variations, typology and destination of use and less on individual architects and construction methods). These readings, however, are not necessarily restricted to work on a binomial axis that ignores other causes. For example, Condit’s work on the Chicago School had also an operative agenda to endorse a “technical-aesthetic synthesis” (*causa formalis*),⁵⁸ and Willis’ analysis of the “vernaculars of

⁵⁶ Carl Condit, *The Rise of the Skyscraper* (Chicago: University of Chicago Press, 1952).

⁵⁷ Willis, *Form Follows Finance*.

⁵⁸ Condit, 3.

capitalism” in New York and Chicago,⁵⁹ did not miss to consider human factors (*causa efficiens*), although the primary agents for Willis were not the individual architects, but the broader socio-economic environment of speculative activity and building regulations of the two American cities.

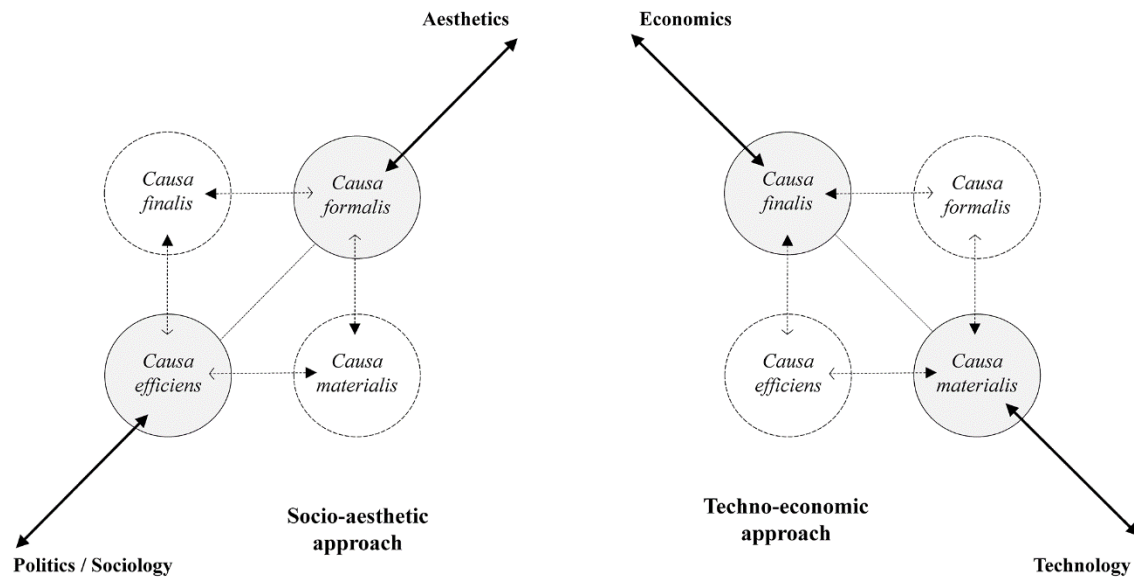


Figure 2.8

The four causes, static-dynamic approaches: socio-aesthetic versus techno-economic

Another two paths of investigation could depart along the diagonals of the four causes as illustrated in Figure 2.8. In principle, this approach would be more interdisciplinary than any of the previous ones described so far, as it would polarise between static-dynamic and physical-immaterial causes in one path. The two approaches on the diagonals would rest on socio-aesthetic assumptions in one case, and techno-economic assumptions in the other. In any case, both paths are suitable, like the others, to include all four causes in the investigation, although two causes would guide the path and the other two would be in support of the others.

For example, following the diagonal of the formal and efficient causes (e.g. architectural forms and designers) a research path could start from socio-political assumptions aimed to promote aesthetics – or vice versa. As discussed in Chapter 1, there is a generous literature

⁵⁹ Willis, 7.

on the architecture of tall buildings that flourished in this sense. Two examples of this approach are the critiques of Charles Jencks⁶⁰ and Ada Louise Huxtable.⁶¹ This approach (albeit with methods and aims very different from the ones used by Jencks and Huxtable) matches also with the one of militant conservation movements, like the one in San Francisco of the 1960s and 1970s.⁶²

The second approach would consider final causes and material causes. With an operative sense that is opposite to the previous one, this approach must develop on techno-economic hypotheses. This approach is nonetheless open to consider formal and efficient causes as well, but on the premise that these are used to verify phenomena connected with building economics and technology. This is the methodological path followed in this research, and the pertinence of this choice for this study is justified for these reasons:

- Giving precedence to techno-economic assumptions, the research can start immune to pejorative socio-aesthetic assumptions, such as those that may derive *prima facie* from pervasive formal homogeneity, ubiquity, simplicity of form et cetera;
- The techno-economic axis is fitting with the process of Schumpeterian creative destruction, and allows verifying the pertinence of this model to explain, in the context of business cycles, the modifications on the built environment induced by skyscrapers;
- This approach is appropriate with the essence of a building typology that is conceived in prevalence for business, or as a form of business, and that needs a high level of technological specialisation to be designed and built successfully.

This research path can then lead to the definition of a set of questions, which in view of the relevance and aims given in the introduction, the hypotheses, and the pertinence of the methods raised so far, can be investigated with specific reference for the city of Melbourne and for its tall office buildings of the second half of the twentieth century.

⁶⁰ Charles Jencks. *Modern Movements in Architecture* (Garden City, NY: Anchor Press, 1973).

⁶¹ Ada Louise Huxtable, *The Tall Building Artistically Reconsidered: the Search for a Skyscraper Style*.

⁶² Bruce B. Brugmann and Greggar Sletteland [eds.] *The Ultimate Highrise: San Francisco's Mad Rush Toward the Sky* (San Francisco: San Francisco Bay Guardian, 1971).

Causa finalis

At first, it is required to understand the end purpose for which tall office buildings are conceived. On one side of the spectrum, there may be a highly speculative aim. The final purpose of a tall office building may be to guarantee a generic and flexible kind of space with good rentability. On the other side of the spectrum, the main purpose may be less speculative. The scope may be to make a building for owner-occupation, or in response to pre-arranged large anchor-tenant occupancy, and serve as the central place of operation of a specific business. These two final causes, however, often can and do coexist in the same building.

At any rate, the finality to provide rentability should not to be mistaken with the scope to gather as quickly and as much as possible earnings or returns. It would be reductive to see tall office buildings as a financial surrogate driven solely by cost-cutting and profit maximising. As confirmed by a number of writings from Australian building economists, good rentability implies attractiveness through architectural quality, which is a complementary enhancer of the purely utilitarian efficiency of the building. A second factor, crucial for the rentability of a tall office building, relates to the time-horizon for which the investment has been set. In other words, it is essential to determine the degree of speculation that was set in response to the expectations of the developer.

Therefore, the questions to investigate in search of the final cause (*causa finalis*) are:

- What degree of speculation was associated with the production of tall office buildings in Melbourne's CBD between 1955 and 1995?
- How did the attitude towards speculative risk change in the same period for these kinds of projects?

These questions can be addressed by referring to information about land ownership and anchor tenant occupancy, particularly at the time of conception of the project. It is also necessary to establish if patterns of owner-occupancy of tall office buildings may have prevailed in relation to different building typologies and in relation to different time periods. Consequently, it is critical to establish if patterns of change of ownership after the

completion of the project may have emerged in time. In essence, this part of the inquiry has to assess strategic changes in time, and if and when a component of owner-occupancy may have prevailed over direct building speculation. In this last instance, a telling sign of high risk-prone speculation may coincide with developments initiated without securing tenants in advance or sold soon after completion.

Causa efficiens

Another source of causation concerns the agent(s) or maker(s) of the buildings. At the most general level, the aim is to identify a source of influence at the techno-economic level of the city. To record those who may have been directly involved as maker(s) of the buildings is a necessity when known. However to record simply key project roles, such as those held by the owner, the architect and the builder, may not suffice to truly understand the efficient cause (*causa efficiens*) of a large group of buildings in an extended period of time.

Reasonably, it should be expected that architects had a central role in the making of these buildings. Given the role as central coordinators and mediators for public approval, architects were in a privileged and pivotal position in the making process of a building. In the particular case of the design of a tall office building, however, the role of the architect is somehow limited or, as put by John Wellborn Root, “paralysed” by the imperative to respond to practical design efficiency and rentability.⁶³

Influences from individuals should not to be underestimated, particularly as they may emerge from single case studies. But in order to recognise general patterns of form-making or purpose-meeting for a broad family of buildings – and therefore at the scale of an entire city and not only of single projects - it is necessary to identify agents who were also representative of a public and collective dimension. The problem of agent-driven causation, in this case, can be addressed at a level of inquiry that goes beyond single buildings and derives from the multifaceted and overlapping definition of place discussed earlier.

⁶³ John Wellborn Root, “A Great Architectural Problem,” *Inland Architect and News Record* 15 (June 1890): 66-71. http://www2.gwu.edu/~art/Temporary_SL/177/pdfs/america_builds_286-301.pdf (accessed 24 February 2014).

The domain of inquiry, in this sense, has to be set at the intersection of public and private interest and in relation to the subjective and specific sense of place given by the local character of the city: Melbourne. This sense of place can be described through the role of public authorities and, more specifically, through the evolution of the instruments of control and regulation that influenced the making of tall office buildings in the city.

To this end, the questions to investigate in search of the efficient cause (*causa efficiens*) are:

- What dynamics of private and public interest were influential in the production of Melbourne's tall office buildings?
- What influence was exercised by public authorities through regulatory controls in the conception, production and built-form of tall office buildings in Melbourne?

The architecture of tall office buildings in Melbourne is considered at a mesoscale of place, an institutional realm where these buildings took place in response to a local sense of character. Evidence of local influence can be documented directly from the public forum where the design of tall office buildings was discussed and assessed in Melbourne, namely the town planning and building approval-related committees of the City of Melbourne.

Causa formalis

The third set of questions aims to the formal aspects of the tall office buildings according to a techno-economic filter. The analysis of architectural form derives from the identification of the *oggetti principali*, the fundamental typological characters of buildings. At the most general level, these characters are expressed by location, shape and size of the floor plan and vertical and horizontal distribution systems of users and services. Within these broad categories of form-making, the question is to identify what specific design strategies may have been used to achieve the level of architectural quality deemed to guarantee flexible rentability or operational needs set for owner-occupation.

To this end, the questions to investigate in search of the formal cause (*causa formalis*) are:

- What strategies of spatial design were used to achieve architectural quality in tall office building in Melbourne's CBD?
- How did these strategies coalesce into particular typological families in time?

These elements should be expounded with specific aspects of spatial configuration, some of which can be ascertained from widespread spatial design strategies aimed to produce the most effective outcomes in office buildings.⁶⁴ Some of the spatial design parameters sought to achieve efficiency in office buildings can be derived from the nomogram sequence described by George Duncan, which suggest the importance of quantities such as size of the land, size of the floor plate, ratio of floor net to gross and number of floors buildable on the land. The aim, however, is not just to list the design parameters to be considered, but to establish how these parameters have coalesced in specific spatial configurations and how and why these may have changed in time.

These questions can be addressed comparing the built form of a sample of tall office buildings in the CBD, reading plans, elevations, sections, historical photographs, historical and contemporary cartography. Key design strategies derived from architectural drawings can be identified by recording, analysing or estimating spatial parameters such as total amount of area, plot ratios, net lettable and gross floor areas, typical distances between envelope to core, building modules, wall to floor area ratios, service core layouts, number and configuration of lift groups, number and vertical configuration of floors in sections.

This set of questions is pivotal and linked to the next and final set of questions. The question of form should gather input also from final and efficient causes, and in this way lead to the last set of questions, which have to deal with technical issues at an international level related to material aspects of construction.

Causa materialis

The fourth set of questions has to consider causation that stems from the materiality of the buildings in question. A building, though, is hardly a mono-material artefact and therefore

⁶⁴ For an exhaustive illustration of these design strategies see Francis Duffy et al., "AJ Handbook Office Building," *Architect's Journal* 157-158, nos. 22, 24, 28, 30, 31, 35, 37 (May - September 1973).

any question surrounding this kind of cause should be multi-fold and potentially never-ending. At a general level, however, the materiality of modern tall office buildings can be condensed by the coexistence of four primary materials: steel, concrete, aluminium and glass. After World War II, in fact, it would be difficult to find a commercial building in Australia that did not make recourse, with different degrees, to any of these four materials. The question of this genre of causation would therefore become, as a minimum, one with four different material facets.

Moreover, if the substance of the building is broken down into the multiple systems and components that are assembled in it, the four pervasive materials of steel, concrete, aluminium and glass may still somehow be inadequate to describe cause and effects. In every single building, each one of these materials would be formed in different ways depending on different purposes established in the design and in the construction process. In the case of tall office buildings of the second half of the twentieth century, the critical building systems to consider would need to address – as a minimum – the four materials in question and the technological developments associated with structural typology, building envelope and environmental service systems. To this end, the questions to consider in search of the material cause (*causa materialis*) are:

- Within the technological milieu of Melbourne's tall buildings between 1955 and 1995, what strategic elements of innovation emerged in relation to structural, building envelope and environmental service systems?
- What elements of techno-cultural influence were established between Melbourne and the United States of America in relation to the design of tall office buildings?

In every building, materials take a multitude of forms according to different human activities, to the durability required by the destination of use, and to the more temporary needs of the construction process. To unravel the materiality of single buildings within a large sample would potentially result into the opening of an infinite sub-set of material causes. In order to manage the vastness of data that would ensue from this approach, it is therefore appropriate to limit the inquiry. Instances that occurred on a multitude of buildings can be inferred indirectly from a broader analysis of the techno-economic context

or by a selective analysis of milestone projects. So, the question of materiality can be investigated at the level of the international milieu of Melbourne, by extrapolating evidence from pace-setting building events, but also from industry-wide developments in materials and building systems, which were able to exercise influence to Australian high-rise and commercial architecture.

Summary

Speculative building activity, architectural quality and the techno-economic environment of a place are elements that influence the architecture of skyscrapers. Intrinsic to this typology is also an essential component of technological change and specialisation.

On this basis, the essence of modern tall office buildings can be searched in a component of architectural quality aimed to secure rentability. This component has to consider subtle typological variations even in apparently simple architectural compositions and needs to operate in a technological milieu open to transnational influences. Based on these two assumptions and applying a four-fold scheme of investigation, the next chapters present how a set of interrelated factors affected the rise, transformation and demise of tall office buildings in Melbourne between the 1950s and the 1990s.

The discussion considers speculation as a *conditio sine qua non* for the tall office building typology. Aspects of built-form are explained in this sense through universal elements of architectural typology, such as site location, floor plan shape and vertical and horizontal distribution. The analysis of these elements is finalised to observe formal variations and patterns of development over the course of time. The agents of the development are searched not only in relation to individual designers, but looking to sources of collective and public influence. Finally, aspects of materiality and technical change are discussed for building materials that became pervasive in modern commercial architecture, such as steel, concrete, aluminium and glass. These technical aspects are discussed for specialist building systems vital for tall buildings: structure, envelope and building services.

The four-fold structure of Aristotelian causation described in this chapter would not benefit from a separation into separate chapters of investigation. In order to understand the several drivers of change, the discussion benefits from an approach that can intersect the

interrelation of different causes; more evidence may transpire, collaterally, by investigating causes that act in concomitance with others. Dealing in synchrony with distinct elements of causation may reveal a picture that is richer than the one given by four blind-folded streams of discussion. For example, the discussion on the end purpose of tall buildings can hardly be separated from considerations about form and stakeholders involved at the time of their conception. Similarly, a discussion on material changes could hardly be left standalone unless specific reference can be made to the formal characteristics of the buildings to be investigated. Moreover, this part of the discussion may need to be sustained by consideration of efficient causes. Finally, the complexity of the interrelationships of this four-fold scheme is bound by a multi-level notion of place and by the need to present chronologically a narrative that deals with a multitude of events and buildings over a period of forty years and in a technological milieu subject to international influences.

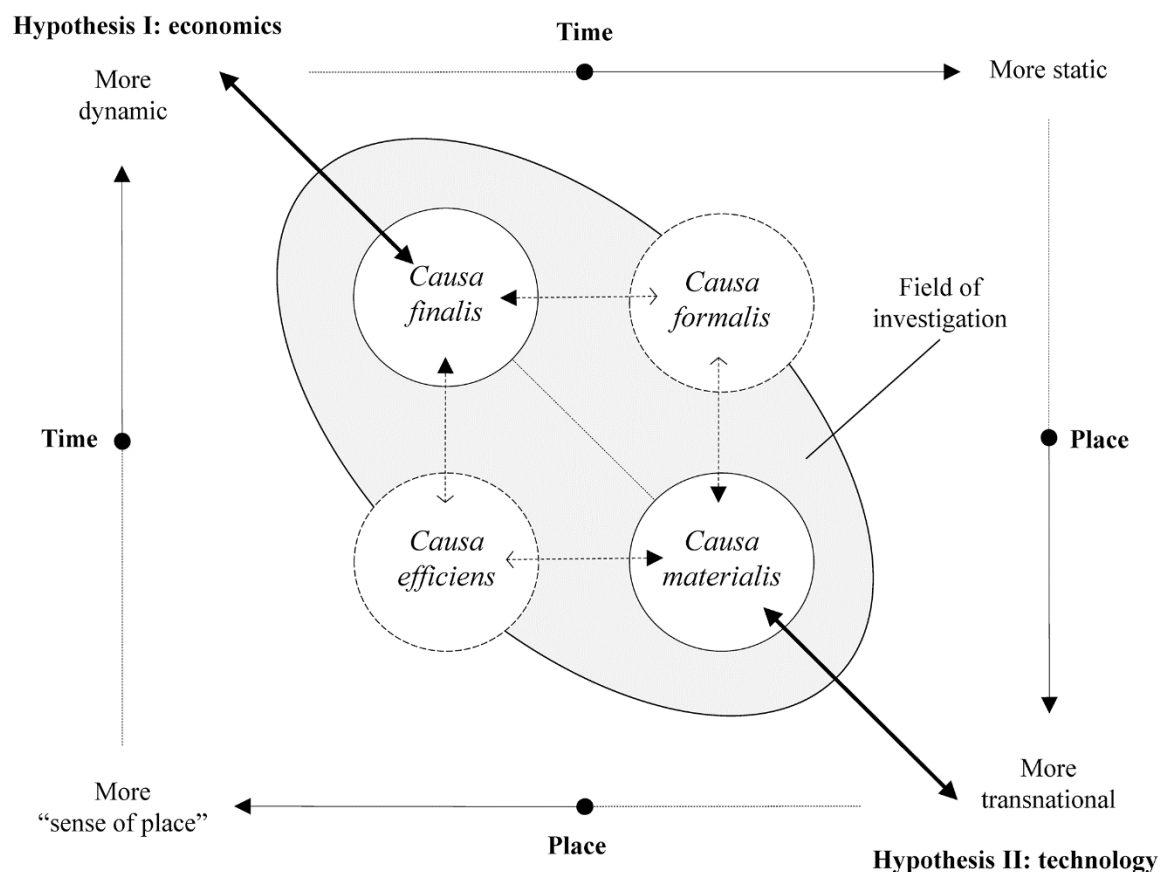


Figure 2.9
Diagram of proposed research path and positioning of hypotheses

For these reasons, the discussion that follows is divided conceptually in two sections, each one originating from the research path and the hypotheses proposed in this chapter and summarised in Figure 2.9. Time and place criteria divide the content into two sub-sets of chapters. The next three chapters (Chapters 3, 4 and 5) use a chronological divider in three stages to discuss matters of end purpose, form and efficient causes and associated with single buildings within Melbourne's Central Business District. Following from the presentation of buildings and events of this section, the second section (Chapters 6 and 7) targets more directly matters of materiality. In these two chapters the discussion expands from Melbourne and Australia, to include evidence of international influences and parallels with the North American context.

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Chapter 3

Genesis (1955-1965)

Ad-hoc skyscraper planning and the quest for office space quality in Melbourne's Central Business Area

It is still necessary to build cities, and the requirements of commerce render it imperative that our cities shall not be wasteful of space. Business 'abhors a vacuum'.

Marcus R. Barlow, 1925¹

The nexus between 'business', inner city density and building regulations affecting high-rise construction was discussed by Melbourne's developers and architects at least since the early 1920s. The notion that the revenue of a property would increase in proportion to the number of floors built upon a site was not new in the city, and, in fact, during the late 1800s, Melbourne had already experienced a major boom in multi-storey construction, which was followed by a major downturn and fall of land prices.²

In the 1920s, at a time when Melbourne was at the onset of another building boom, a case for building taller was advocated by the Australian architect Marcus Barlow,³ following trends of economic and urban development of the largest American cities (New York, Chicago and San Francisco). In the same period, the cost of land in Melbourne was deemed as a constant, without significant variations in relation to density of development. This fact encouraged developers to capitalise on the size of the building itself rather than speculate on land values.⁴ As a result, alongside the institutional and religious buildings of the late 1800s and the earliest skyscrapers of the city, a number of new bulky office blocks were built in the 1930s. These buildings survived intact during the calm of

¹ Marcus R. Barlow et al., "Discussion on 'Taller Buildings for Melbourne'," *Journal of Proceedings of the Royal Victorian Institute of Architects* 23, no. 5 (September 1925): 98-107.

² Michael Cannon, *The Land Boomers* (Carlton, VIC: Melbourne University Press, 1966); Graeme Davison, *The Rise and Fall of Marvellous Melbourne* (Carlton, VIC: Melbourne University Press, 2004).

³ Marcus Barlow (1890-1954) was an influential architect and designer in Melbourne of the first half of the twentieth century. Barlow is well-known in Melbourne for the design of two Art Deco-inspired buildings in Swanston Street, the Manchester Unity Building, completed in 1932, and the Century Building, completed in 1940.

⁴ Barlow, "Discussion on 'Taller Buildings for Melbourne'," 99.

building activity of World War II and were inherited, after the war, representing, for a new generation of Melbournians and architect, the major commercial landmarks of the city.⁵



Figure 3.1
Central Business Area, Melbourne, aerial view, 1967

After 1945, in a time of nation-wide high building costs, difficulty of raising capital, steel shortages and ongoing limitations derived by war restrictions,⁶ Melbourne did not experience significant opportunities for large private commercial construction.⁷ In the mid-1950s, these conditions of stagnation changed substantially. In 1952, only 562 building applications were submitted to the Building Surveyor for an estimated cost of £1,164,000. By 1956, the volume of applications had almost doubled and the total value

⁵ David A. L. Saunders, "Office Blocks in Melbourne," *Architecture in Australia* 48, no. 2 (June 1959): 91.

⁶ C.R. McKerihan, "Australia's Present Financial Entanglements," *Building and Engineering* 24, (December 1952): 51.

⁷ John Davidson, interview, 28 November 2014.

of projects lodged for approval had grown more than twelve times since 1952. These figures signalled the passage from a market of small, low budget projects to one of larger projects and a return of commercial activity in construction.⁸

The year of 1955 was, for Melbourne, the beginning of a phase of economic growth marked by increased construction activity in the Hoddle Grid and its fringes. This activity was partly in response to the preparation for the Olympic Games, which were held in the city in 1956, and it was accompanied by a return to commercial construction activity. In 1951, counting private and government offices, the inner city had 11,242,000 square feet of office space. By 1962, the total amount of office floor space had grown by 40%, to 15,800,000 square feet.⁹

Within a decade, a large share of this increase of office floor space was taken by privately owned and developed multi-storey office buildings, which played an important role for the construction industry as catalysts for new ideas and technologies. Tall office buildings in the 1950s embodied new models of workplace planning and commercial construction, and offered challenges and triggered changes to inner city planning policies.

3.1 Practicality and experiments

Office building within the constraints of the post-war Central Business Area

Growth by substitution

The 1950s, in Australia, were a difficult time for raising capital and investing in construction. In an economic context that was still heavily reliant on traditional farming methods, part of this difficulty derived by the seasonal modality of capital inflow.¹⁰ At the same time, the price of land, at least in the most prestigious business addresses of the city, remained prohibitive.

A major commercial project of the time confirms the contingent difficulties that affected inner city development in those years. The office block at 100 Collins Street, completed

⁸ Public Record Office of Victoria (PROV), City of Melbourne, VPRS 8945/P2, unit 191, Building and Town Planning Committee, meeting minutes, 184, item n. 56/5201, [1955-57].

⁹ City of Melbourne, *Report on Town Planning Surveys of the Central Business Area of the City of Melbourne* (Melbourne: City of Melbourne, 1963), Table I: "Use of Floor Space."

¹⁰ Oliver Marriott, *The Property Boom* (London: Hamilton, 1967), 206-211.

in 1955 and designed by architect John La Gerche, is recognised as one of the earliest examples of the “glass-box” modernist office buildings of the post-war period in Melbourne, and as a symbol of the “recovery in commercial building” after the war.¹¹ Significantly, the project was developed due to the joint efforts of a group of smaller individual proprietors who set up a cooperative enterprise of development, Gilbert Court Pty Ltd. This novel method of development, in this case, allowed smaller proprietors to purchase a vacant block of land at the eastern end of Collins Street - a property that none of the co-proprietors could have afforded otherwise on the basis of individual ownership.¹² [Map 8A, 01]

In these difficult economic conditions, in order to assist land owners who struggled to find adequate resources for redevelopment, the City of Melbourne reviewed its system of land taxation. The new method assigned rates based on the net annual value of the capital improved property, rather than on the value of the land.¹³ In the years that followed, redevelopment by substitution of pre-owned properties became the prevailing approach to new commercial construction. New developments were mostly sponsored by insurance companies eager to build new and larger premises. These buildings were primarily owner-occupied with some space allocated also for rental to smaller businesses. Nonetheless, in the mid-1950s, land prices in the inner city remained high, preventing large operations of consolidation for most land owners, including prestigious international investors.

In 1954, London-based insurer Sun Alliance, at that time one of the largest in the world, was not in a position to purchase land in Collins Street besides its pre-owned property at numbers 408-410. The owner opted instead to demolish the existing building and build in its place a modern office block [Map 6A, 02].¹⁴ A similar approach was followed by the adjoining owners of Atlas Insurance at 404-406 Collins Street.

¹¹ National Trust Database, file B6095.

¹² “100 Collins Street,” *Architecture and Arts* 26 (October 1955): 37.

¹³ Saunders, “Office Blocks in Melbourne,” 91.

¹⁴ “Alliance Office Building,” *Architecture and Arts* 40 (February 1957): 29.

The new premises of the Allan's Music Store,¹⁵ at 276 Collins Street, were the result of the replacement of the 1850s built premises that were destroyed by a fire in 1955 [Map 7A, 07]. The headquarters of the Coates Building Company at 18-20 Collins Street,¹⁶ were built as a replacement of three bluestone and brick houses, which had been owned by the Coates' family since the first land sale of Melbourne in 1840. [Map 8B, 11]

Similar patterns of redevelopment by substitution were common in Queen Street. The new office building for the Union Insurance Society of Canton was built on the site of the pre-existing York Chambers Building,¹⁷ and on an adjacent parcel, the Norwich Union Fire Insurance Society decided to replace its two-storey headquarters with a new thirteen-storey infill block [Map 6C, 04].¹⁸ These office buildings shared the same strategy of small intervention by substitution, but they could differ significantly in terms of cost and space quality.

Cost, quality and size

Critic and architectural academic David Saunders reviewed a number of office blocks built in Melbourne in the period between 1955 and 1958 and identified, according to cost, four quality-based typologies.¹⁹ The first group was built for a cost between £450 and £500 per square (100 square feet) and included, among others, the investment-built block, known as the 'filing cabinet job', developed in 1958, at 406 Lonsdale Street, by the Australian Mutual Provident Society (AMP). [Map 2B, 08]

The second group had a cost bracket between £600 and £750 per square; this included examples like the Allan's Building and Gilbert Court. The third group was costlier, between £800 and £900 per square, and included the Alliance Insurance and the Atlas Insurance buildings in Collins Street, and the new Hume House in William Street. [Map 1D, 05]

¹⁵ "Office Building, Melbourne," *Architecture and Arts* 62 (December 1958): 23; "Home of Music," *Architecture Today* 1, no. 1 (November 1958): 30.

¹⁶ "Office Building Melbourne," *Architecture and Arts* 70 (August 1959): 36-37.

¹⁷ "New Office Building, Melbourne," *Architecture and Arts* 53 (March 1958): 29.

¹⁸ "Office Building, Melbourne," *Architecture and Arts* 54 (April 1958): 43.

¹⁹ Saunders, "Office Blocks in Melbourne," 92.

The fourth group had a cost in excess of £950 per square and included the new headquarters for the Imperial Chemical Industries of Australia and New Zealand (ICIANZ) in Nicholson Street, East Melbourne. [Map 9A, 06]

Similar figures for the upper end of the four groups emerged from a survey of cost comparison of air conditioned buildings prepared in 1958 by the architects Stephenson and Turner (See table below).²⁰

Period	Address	Building	£ per square (1958)
1956-57	185 William Street	Hume House	£830
1956-58	53-57 Queen Street	Norwich Union Insurance Society	£920
1954-59	408-410 Collins Street	Alliance Insurance	£815
1956-58	224-236 Queen Street	ANZ Bank	£834
1957-59	386-392 Lonsdale Street	Electrolytic Zinc	£1,066
1956-58	1 Nicholson Street	ICIANZ House	£900 - £1,040

Table 3.1 – Comparative cost per square of office blocks built in Melbourne inner city area. 1956-58

Yet, differences, whether larger or smaller, were reflected more significantly by quality and typology of space. By following typological character and project size, the buildings of the decade 1955-1964 can be more conveniently divided in two groups. One consists of first tier projects, mostly developed to be occupied by their owners, which were leading corporations of the time. The other consists of second tier buildings developed to target lower rentals and smaller business or professional tenants.

First tier office buildings, were taller and larger and built on generous sites aggregated by operations of consolidation. These projects incorporated a typological approach with a clear definition of flexible office space that was served by a detached - or laterally embedded – service core. Other characteristics of these office buildings were a pronounced excess of height in relation to surrounding parapets and a total net lettable area larger than 90,000 square feet.

Besides ICIANZ House, another handful of buildings belonged to the first tier group of buildings of the 1950s and early 1960s: Shell Corner [Map 1D, 12], the RACV Building

²⁰ State Library of Victoria (SLV), Stephenson and Turner Archives, volume 3279, CML-1-2B, Stephenson and Turner Architects. “Comparative Cost Data on Recent Office Buildings,” 11 June 1958.

[Map 6A, 15], HC Sleigh Corner [Map 2D, 21], the Colonial Mutual Life Building [Map 6B, 17] and the CRA Building [Map 8C, 18]. With the exception of ICIANZ House, which was completed in late 1958, the rest of these buildings were designed in the late 1950s and completed between 1960 and 1964.

By contrast, second tier office buildings had smaller floor plates and less total floor space. These buildings were either built as infills at mid-block narrow parcels, such as London Assurance House [Map 2C, 09], along mid-block laneways, such as the Electrolytic Zinc Company [Map 2B, 10] or located more prominently on corner sites, such as the ANZ Savings Bank at corner of Queen and Lonsdale Streets [Map 25, 03].

A practical boom

With the limited opportunities for new land acquisitions of the time, the majority of second tier office buildings of the times were developed with a sense of practicality. Site opportunities had to be maximised whenever possible to meet new demands for quality workspace, access to natural light and services. Most of the time, the results were a compromise between these demands and older models of workspace design.

Gilbert Court, for example, was completed on a block of land of just 3,660 square feet. Flexibility of the floor plate was compromised by the requirement of the Building Surveyor to locate an escape stair on the opposite corner of the main service spine, which aligned with the western side of the building.²¹

Until the end of the 1950s, new office buildings were erected on parcels of land that ranged from 4,000 square feet to 10,000 square feet. The total net rentable floor space produced by the buildings varied considerably. Most new office blocks accommodated between 10 and 13 floors and reached the maximum density allowed by a regulatory control that limited height to a maximum of 132 feet. On the smaller side of the spectrum, buildings such as Gilbert Court had a total net lettable area of less than 28,000 square feet. A number of blocks built towards the end of the 1950s and during the early 1960s (e.g. Electrolytic Zinc, Coates, Prudential Building, AMP at 406 Lonsdale, HC Sleigh Corner) had total floor areas between 70,000 and 90,000 square feet.

²¹ “100 Collins Street,” *Architecture and Arts* 26 (October 1956): 37.

Size and geometry of the typical floor plates varied accordingly. The Allan's Building in Collins Street was an extreme case on the smaller side of things. The building was erected on a narrow frontage of 30 feet and the floor plan maximised usable floor area with a deep and narrow column-free space.

In the rental market of the 1950s, column-free space was a rare characteristic of the building stock. Most of the floor plates of the early office blocks in the central city gained natural illumination from light courts and secondary frontages facing narrow secondary streets. Interior spaces, before the 1960s, even in relatively small side-core examples such as Hume House, were normally punctuated by a grid of columns running along the perimeter and the middle, splitting the floor plate into two parts.

Older configurations and modern devices

Within the inner city, the newest office blocks of the 1950s were built, whenever possible, on sites with their main frontage facing eastwards. This preference was evident particularly in Queen Street. Consciousness of orientation was reflected also by buildings placed in the north-south direction, where the lift block was preferably located on the western side of the floor plan.

City buildings could not avoid exposure to the uncomfortable western sun of Australian summers all the time. The Electrolytic Zinc Company Building in Lonsdale Street [Map 2B, 10] resolved a problematic western orientation with the use of vertical louvres as sunshades. In this building sun louvres were more than a measure of ameliorated comfort. Louvres allowed the size of the air conditioning plant to be reduced by 30%, which brought considerable savings for initial and running costs.²²

Innovation occurred also at typological level with the vertical distribution of the parts. In 1955, the unbuilt Fuller House at 200 Little Collins Street [Figure 3.2], designed by Austrian-born architect Harry Seidler in collaboration with University of Sydney lecturer Peter Miller, was described as "revolutionary" for combining in the same building elevated office space and parking space on a podium.²³ A few years later, the speculative building at 406 Lonsdale Street would be the first building in Melbourne to be built with

²² "First Office Building to Have West Wall Sun Controlled with Vertical Louvres," *Architecture Today* 1, no. 11 (September 1959): 24-26.

²³ "Revolutionary Office for Melbourne," *Architecture and Arts* 25 (September 1955): 38-39.

elevated floors entirely devoted to car parking.²⁴ Later on, the RACV Building in Queen Street [Map 6A, 15] was possibly the first office development in Melbourne to combine a mixed program of office space and hotel accommodation with a tower sitting on a podium of public facilities.²⁵

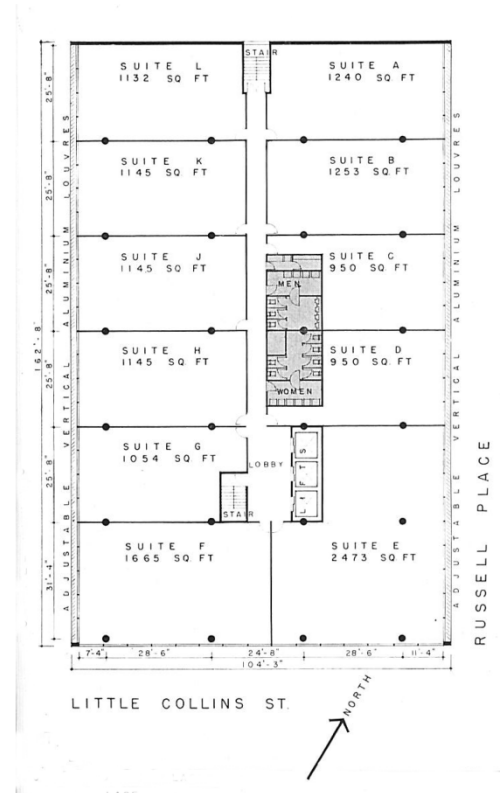
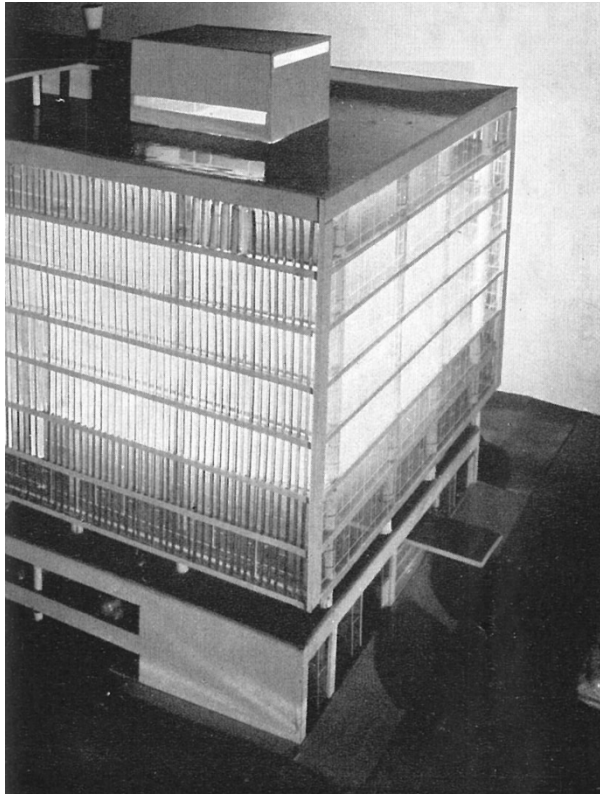


Figure 3.2

Fuller House, 200 Little Collins Street (unbuilt); model view and typical plan

3.2 The slab and the shaft

Quality benchmarks of modern space

ICIANZ House [Map 9A, 06],

In 1958, the Imperial Chemical Industries of Australia and New Zealand built its Melbourne headquarters on a site of approximately 25,000 square feet at 1 Nicholson Street. The site was the result of the consolidation of several properties along Nicholson

²⁴ "Office Building, Melbourne," *Architecture and Arts* 53 (March 1958): 30.

²⁵ "Royal Automobile Club of Victoria," *Architecture in Australia* 50, no. 3 (September 1961): 92-93; "Club Premises and Offices," *Architecture Today* 3, no. 7 (May 1961): 17-20.

Street, Albert Street and Evelyn Place, all of which were purchased by the company in 1952.

Access to good transport facilities was the main motivation to build on a site on the East Melbourne fringe, rather than directly in the Central Business Area.²⁶ The building, ICIANZ House, was conceived mostly for owner occupancy and it was considered by the owner as an advertising vehicle for the owner's chemical products in the construction industry. As an advertisement of the chemical company noted, "wherever possible, ICI products" had been used "in its construction, its fittings and equipment".²⁷

The tower was a rectangular slab of 17 office floors served by 8 lifts. After completion, twelve of these floors were occupied by the owner. At ground floor, with landscape surrounding, there was a bank tenancy and a lecture theatre. The basement housed a car park and part of the mechanical plant. The rest of the mechanical plant was located on a 'penthouse' set back from the parapet on top of the roof.

ICIANZ House, designed by local architect Bates, Smart & McCutcheon, was celebrated as the "first skyscraper" in Melbourne and in Australia.²⁸ The journal *Architecture and Arts* noted that its concept was "born in Le Corbusier's mind" fifty years earlier, and that the "true ideological fathers" of the project were Wallace K. Harrison, Ludwig Mies van der Rohe and Walter Gropius.²⁹ As the Australian critic Robin Boyd described, a separation between the slab and the service core was a functionally balanced juxtaposition of "male and female" that was worthy of the best examples of the International Style.³⁰ Later on, the National Trust of Australia declared that the Lever House in New York was its "basis and inspiration"³¹. Notwithstanding possible aesthetic influences from these and other international examples, the most significant typological basis of the building was more likely the Inland Steel Building in Chicago, a building with which ICIANZ House shared affinity most of all in plan.

²⁶ "Australia's First Skyscraper: ICI House, Melbourne," *Architecture Today* 1, no. 2 (December 1958): 31.

²⁷ Imperial Chemical Industries of Australia & New Zealand, advertisement in *Architecture Today* 1, no. 2, (December 1958): 6.

²⁸ "Melbourne's First Skyscraper!" *Architecture and Arts* 43 (May 1957): 26.

²⁹ "I.C.I. House, Melbourne's First Skyscraper," *Architecture and Arts* 61 (November 1958): 26. See also "Australia's First Skyscraper ... ICI House, Melbourne," *Architecture Today* 1, no. 2 (December 1958).

³⁰ Robin Boyd, *The Puzzle of Architecture* (Melbourne: University of Melbourne Press, 1965), 15.

³¹ PROV, City of Melbourne, VPRS 8945/P2, Unit 215, Building and Land Use Committee, Meeting Minutes, 15 October 1980.

The historical significance of the building went beyond merits of architectural aesthetics. In a city with a new land taxation system based on capital improved values, the improvements of a large office development on a consolidated block of land converted to significant revenues for Melbourne City Council. Before the properties at the corner of Albert and Nicholson Streets in East Melbourne were consolidated, the City of Melbourne charged for all the land on the block annual rates for a total £363. After five years, with ICIANZ House completed, the same land had multiplied rates by more than fifty times.

Properties consolidated by ICI in 1952 ³²	Site Area (sq ft)	Annual Value	Rates (1955-56)
510-518 Albert Street	6,969	£700	£103
530 Albert Street	2,520	£180	£26
2 Nicholson Street	4,212	£500	£72
4 Nicholson Street	3,550	£900	£131
1 Evelyn Place	3,550	£130	£18
3 Evelyn Place	2,397	£94	£13
TOTAL	20,678	£2,504	£363
Total adjusted to 1960-61 ³³		£2,897	£420
Consolidated property ³⁴			
1 Nicholson Street	25,232	£150,000	£21,250

Table 3.2 – Comparison of City of Melbourne annual rate revenues of the land parcels occupied by ICI House, before and after the land consolidation required for the project

New benchmarks

ICIANZ House set new benchmarks of office space quality and rental price in the city. Second tier office blocks of the 1950s, with less demands of vertical circulation, had floor plates that could easily meet reasonable floor plate efficiency, as a ratio between net lettable and gross floor area. For example, the Coates Building in Collins Street [Map 8B, 11], despite a profile of re-entrants with two light courts along the eastern side, had an efficient ratio of 86% of net to gross area. Even the narrow-fronted Allan's Music Store managed to reach a typical efficiency in plan of 83%. The typical plan of ICIANZ's slab had instead a more modest efficiency of 79%.

³² PROV, City of Melbourne, VPRS 5708, Rate Books, 1955-56, Latrobe Ward.

³³ Adjustment factor based on annual average from Australian Bureau of Statistics, 'Consumer Price Index' (6401.0) Canberra, 1997 [Period from 1949/50 to 1996/97].

³⁴ PROV, City of Melbourne, VPRS 5708, Rate Books, 1960-61, Latrobe Ward.

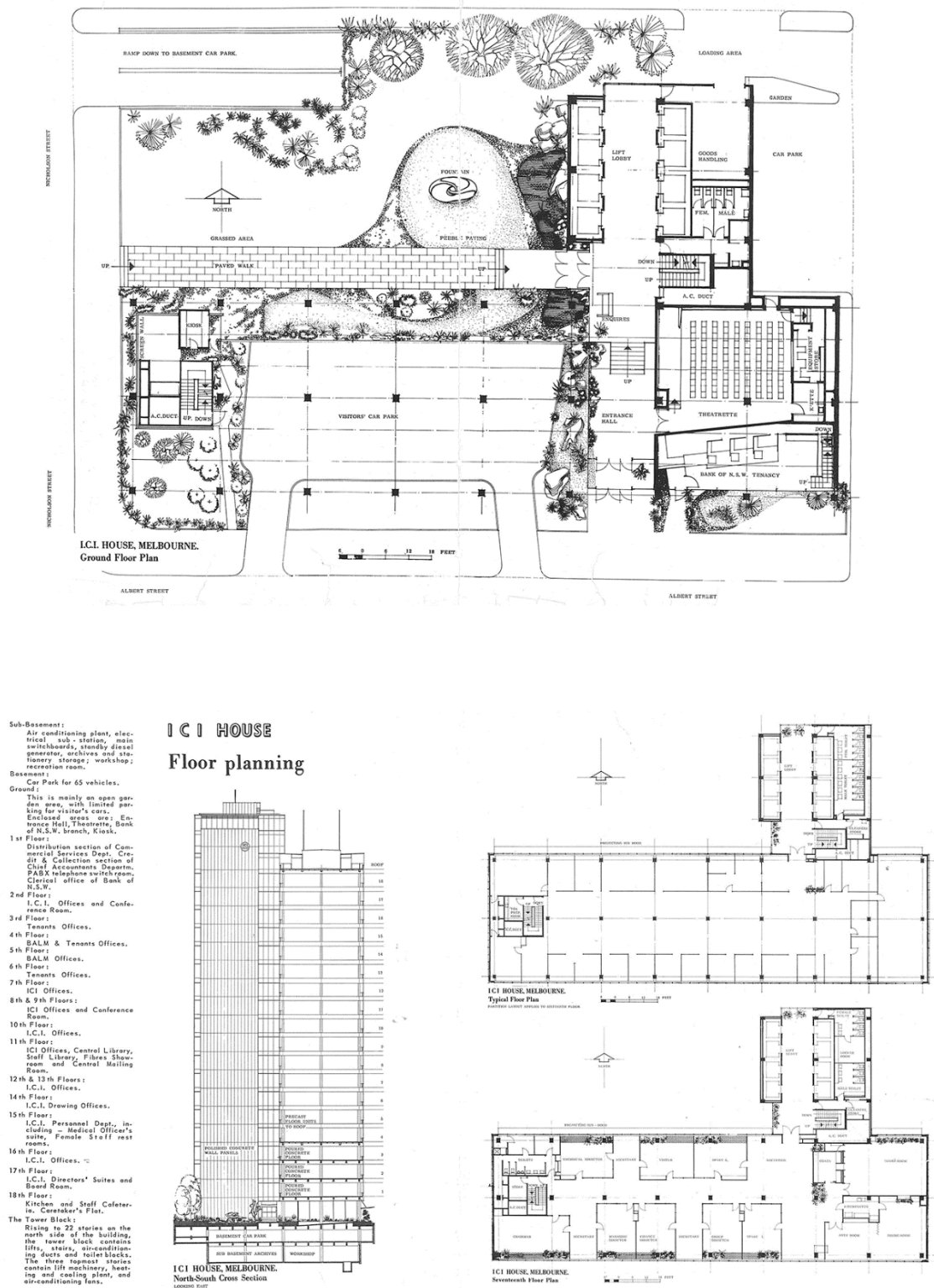
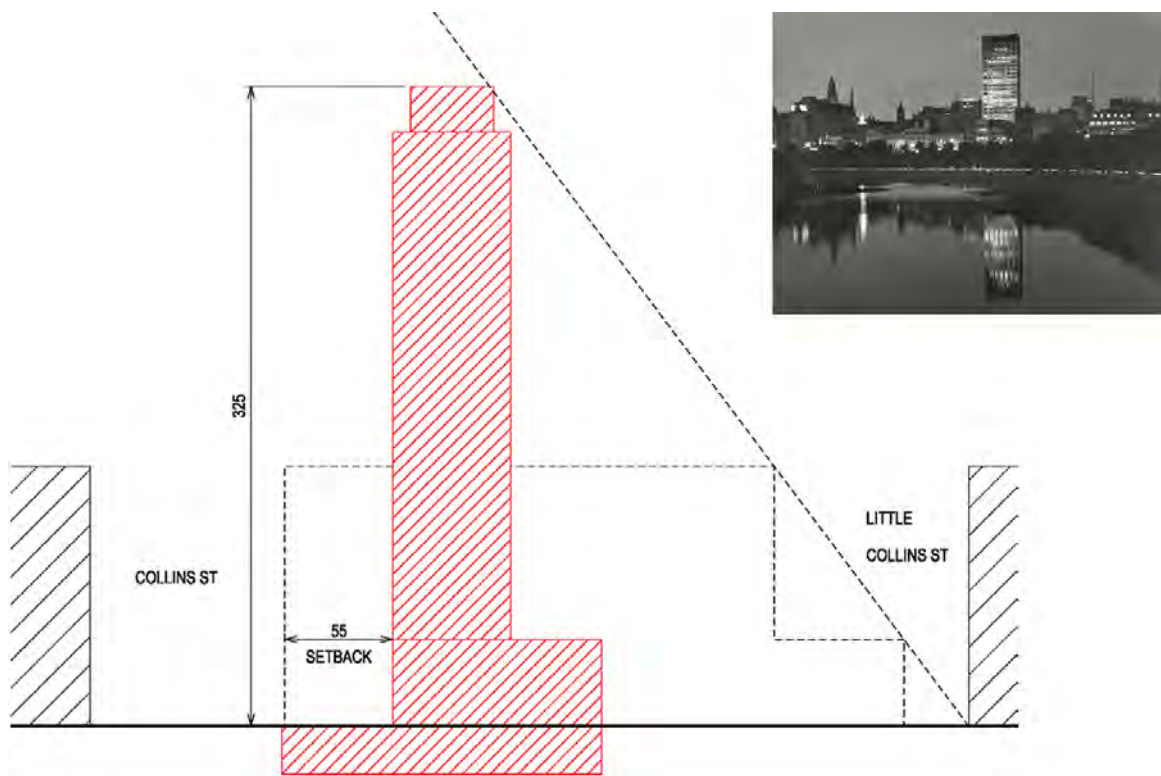


Figure 3.3
ICI House, 1-4 Nicholson Street; site plan, typical plans and cross section

**Figure 3.4**

CRA Building, 89-101 Collins Street; site section and set back diagram

Novel benchmarks of space quality could not be simply measured numerically. With a new record breaking height of 265 feet, the bar had been set quite high for panoramic views, but building height was not all that mattered for prestige. Prestigious office space was a matter of quality expressed by floor plate shape, layout and size. Freed by the opportunities of a large consolidated site, Bates, Smart & McCutcheon configured the slab with a floor plate of 190 feet by 54 feet, which had plenty of unobstructed views and daylight and total area about twice the size of any other contemporary major office blocks in the city. For the standards of Melbourne at that time, ICIANZ House was in fact a giant, not only in terms of height, but mostly for a typical floor area of 10,000 square feet and for a total floor space provided in a single building of more than 180,000 square feet.

CRA Building [Map 7A, 07]

In the late 1950s, the Consolidated Zinc Company of Australia, later known as Conzinc Riotinto Australia (CRA), decided to build its new headquarters at 95 Collins Street [Map 8C, 18]. The new building replaced a group of flats that the company had earlier

converted to office use. This “shaft-type” tower,³⁵ conceived by the architect Bernard Evans, rose up as a “finger in the sky” at 325 feet above the street level.³⁶ When it was completed in 1961, the CRA took away from ICI House its short-lived title of the tallest building in Melbourne. Prestige for height, however, was offset by disadvantages imposed by a mid-block site and by negotiations with Melbourne City Council, which required 50 feet set back from the street. The twenty-seven storey-high tower had a small floor plate of 4,630 square feet. Furthermore, building height imposed heavy requirements on lifts that resulted in a floor plan of modest efficiency. Space quality was further compromised by the presence of the service core, which occupied most part of the southern side. Despite being the tallest building in the Hoddle grid, and the first to make use of an intermediate mechanical floor, the CRA headquarters was not among the largest office blocks of its time; it had rather small floor plates and an overall net lettable floor space that was barely half of that at ICIANZ House.

Shell Corner [Map 1D, 12]

In the late 1950s, the western side of the city grid was largely occupied by low-rise industrial buildings and warehouses. Use of the land in that part of the city slowly started to change in the early 1960s, when some new office buildings were completed along William, Bourke and Queen Streets.

On the north-western side of the corner of Bourke and William Streets, two blocks of land were owned by the Shell Company of Australia.³⁷ In the late 1950s, the Mutual Life and Citizens Assurance Company (MLC) bought the southern-most of the parcels and an existing four-storey building, known as ‘Shell Corner’. Between 1958 and 1960, the Shell building was demolished and replaced with a new modernist office building leased back to Shell with a long-term rental agreement of 40 years.³⁸

Shell Corner was 223 feet tall. It had an overall net lettable area of 90,000 square feet and it was designed by the San Francisco office of Skidmore, Owings and Merrill. Considered as a fitting example of the International Style of the times, the building received media coverage both locally and internationally. Shell “needed large open spaces which could

³⁵ “Melbourne’s Newest Skyscraper,” *Architecture and Arts* 10, no. 3 (March 1962): 33.

³⁶ “Melbourne’s Newest Skyscraper,” 33.

³⁷ PROV, City of Melbourne, VPRS 5708, Council Rates, 1955-56, Lonsdale Ward.

³⁸ Melbourne CBD Cityscope, Map 19, Property 55, 1977-1991.

be used in a variety of ways”, and the solution provided by the architects was open space within a 38 feet and 8 inches column grid, which had to be reconciled with limited floor to floor height. The latter restriction was necessary to satisfy Shell’s wish to connect a three-storey-high bridge to their adjacent 1930s building.³⁹



Figure 3.5

Shell corner: existing conditions and new office block completed in 1960

The new Shell building was a rectangular block of the ‘shaft type’, a tower geometrically not dissimilar from the CRA building, but more efficient, flexible and technologically sophisticated. The rectangular plan had an exact aspect ratio of 1 to 1.5 with a footprint of 108 feet by 72 feet. The floor plate had a net lettable area of 4,630 square feet and an efficiency of 78%. The rigorous modular coordination of six square structural bays was based on a square module of 4 feet and 7 inches that determined structure, façade, ceiling grid, and the possible location of the partitions. A symmetrical side core with a central lift lobby was embedded in the floor plate, leaving the rest of the floor plate largely open, with a depth that reached up to almost 45 feet in the centre and which guaranteed flexibility for Shell and for its international high profile corporate sub-tenants (General Motors and Ford).⁴⁰

³⁹ “Four Office Buildings: Four Different Schemes,” *Architectural Record* 125, no. 4 (April 1959): 168-69.

⁴⁰ Cityscope, Map 19, Property 55.

Corner of Queen and Bourke Streets

Insurance companies were the key drivers of commercial development in the city. These investments coalesced particularly along Queen Street, a street known to be less noisy than others due to the absence of tram lines.⁴¹ Office developments had traditionally appeared in the southern part of Queen Street since the late 1800s and, after WWII, several relatively affordable and large blocks at the corner of Bourke and Queen Streets were still vacant or under-developed.⁴²

By 1964, the intersection of the two streets was occupied by four brand new office towers; three of these were headquarters of insurance companies and three were also owned by insurance companies. The paradigm of modern office quality that BSM and SOM had initiated in Melbourne, respectively at ICIANZ House and Shell Corner, evolved further with new themes, at this city intersection.



Figure 3.6

Corner of Queen and Bourke Streets, Melbourne, map and fisheye view of office buildings completed in the early 1960s

The south-east corner was developed for owner occupation by the Prudential Assurance Company. The Prudential Building [Map 6B, 13] demonstrated a common trend of the time to adhere to existing height limits by minimising floor-to-floor heights. In this case,

⁴¹ Robert A. Eggleston "The Modern Office Building," *Journal of the Royal Victorian Institute of Architects* 36, no. 1 (March – April 1938): 6-18.

⁴² Saunders, "Office Blocks in Melbourne," 92.

precast concrete planks of double-tee section allowed the housing of services in between the beam flanges, thus managing to fit twelve rentable floors over a ground floor of retail.⁴³ Conceived as a rather economic form of investment - the building did not have air conditioning - the Prudential was built on an almost uninterrupted footprint facing Bourke Street of 132 feet and 52 feet depth that was split in half by mid-span columns.

On the south-western corner, the Pearl Assurance Building [Map 6A, 16] was also developed for owner-occupancy. The tower was based on a square footprint of 71 feet served by an end core on the southern side. A common approach followed for office buildings of the time was to house mechanical plant at the top of the building, either exposed or inside an independent penthouse volume set back from the parapet. The Pearl Assurance Building was one of the first buildings in Melbourne that attempted to reconcile these ancillary additions at the top of the building into a crowned monolithic volume. The building terminated as a squarish block with a flat roof attic, behind which mechanical rooms were disguised by metal fins, large signage and - in lieu of the conventional flagpole of the times – a thirty feet high spire terminated by a five feet diameter wide “pearl” of fibre glass.⁴⁴

The north-west corner of the intersection, at 155-161 Queen Street, was developed for speculation by the Statewide Building Society and rented to the South British Insurance Company, from which the building took its name [Map 2C, 20]. The building, designed by Bates, Smart & McCutcheon, had a floor plate completely free of columns with a depth of 36 feet from the façade to the service core. This small block reached 176 feet height from the ground with an overall gross floor area of 68,000 square feet. The South British Insurance Building rose from a small site of 97 by 57 feet. The building was approved for 150 feet in height with an amendment of the UBR gained in return of open space at ground level. The plan maximised economic opportunities on a difficult site, and the problems of a small floor plate were offset by a successful negotiation with the City of Melbourne, which determined approval to use air rights over public land. The upper floors were in fact built over Benjamin Lane, a small street that granted rear access to

⁴³ “Preponderance of Practicality,” *Architecture Today* 2, no. 7 (May 1960): 20-25.

⁴⁴ “Pearl Assurance Building, Melbourne,” *Architecture Today* 3, no. 5 (March 1961): 17-18.

adjoining properties.⁴⁵ The project had other important regulatory departures. The prescriptive requirement of sprinklers for the floors above a certain height limit was exempted on the basis that there were two fire-isolated stairs, a fireman's lift (large enough to carry a stretcher) and a roof tank suitable for fire-fighting with water storage.⁴⁶

The fourth corner, at north-east of the intersection, was developed by the shipping company HC Sleight at 158-162 Queen Street [Map 2D, 21], which soon after completion sold the building to the Prudential Insurance Company with a leaseback agreement of forty years.



Figure 3.7

HC Sleight Corner, 158-162 Queen Street, 1962-64; internal view of typical floor and street view

Unlike South British Insurance, which had to struggle with air rights over a laneway to assemble a rather small floor plate of 3,600 square feet, the new HC Sleight gave demonstration of the benefits of column-free open space in combination with a larger footprint. The building had a side core configuration like ICIANZ House, with a service core detached from a floor plate of 145 by 46 feet. Office space was fully sealed and air conditioned and had approximately 6,400 square feet of net office space per floor, almost double the size of nearby South British Insurance. The floors were supported by steel

⁴⁵ PROV, VPRS 8945/P2, unit 192, Building and Town Planning Committee, minute n. 59/4020, 289 [1959].

⁴⁶ "Offices," *Architecture in Australia* 51, no. 1 (March 1962): 104.

beams spanning 45 feet. With the exception of a stair block on the eastern end, the slab had an interior space that offered maximum flexibility free of structural obstructions. HC Sleigh Corner revealed that first tier rental returns, when offered in conjunction with quality space of maximum flexibility in larger floor plates, could be justified outside the prime office address of Collins Street. In 1964, the building set a new benchmark for rentals in Melbourne charging a rate of \$5 per square foot.⁴⁷

3.3 **The unlimited city**

Building height, fire-safety and the gap between praxis and prescription

At any required height

Between the mid-1950s and the early 1960s, the city of Melbourne came to address the problem of building ‘taller’, a matter of contention which had originated at least thirty years earlier and that had been anticipated by discussions between architects and fire authorities.

A proponent of change was architect Marcus Barlow, who in 1925 delivered a speech at the Royal Victorian Institute of Architects (RVIA) to advocate a review of inner city building regulations to allow for “taller buildings”.⁴⁸ Barlow suggested amending a regulatory control established in the city in the early 1914, which had set a building height limit of 132 feet height. This limit, according to Barlow, could have been replaced by a new one of 300 feet applicable for the larger streets of the city. The proposal was discussed on the occasion at the RVIA with Harrie B. Lee, the Chief Officer of the Melbourne Metropolitan Fire Brigade (MMFB). Opposition to Barlow’s ideas, however, came mostly from other architects, who were motivated by different concerns for urban congestion. Barlow’s position, on that occasion, was even accused of placing more importance on the “financial” aspects of architecture than on those of “humanitarian” interest.⁴⁹

The MMFB representative, by contrast, left the ground open for further discussion. In response to Barlow’s questioning of the maximum length of fire ladders available in

⁴⁷ Richard Ellis Sallman & Seward, Collins Place Development Submission, 1971, Feasibility Study Report and Market Analysis.

⁴⁸ Barlow et al., “Discussion on ‘Taller Buildings for Melbourne’,” 98-107.

⁴⁹ K. A. Henderson, quoted in Barlow et al., 102.

Melbourne, which since 1914 were claimed as instrumental for setting the building height limit at 132 feet, Mr Lee noted that the Metropolitan Fire Brigade in Melbourne had fire-fighting equipment that was “equal to anything in the world”.⁵⁰ The Chief Officer remarked that rather than resting on fire-fighting equipment matters, the problem of building taller was dependent on appropriate methods of construction, which in his view seemed to be lacking in Melbourne. Some of the methods that Lee identified as desirable consisted of water towers on roofs, fire-resisting compartments and, most of all, the use of fire-resistant structural construction. The Chief Officer concluded that “any required height may be built to with safety, if provision for fire-resisting and fire-fighting [is] made”.⁵¹

In 1931, Barlow returned to debate on building taller, when the financial prospects of growth of the city appeared to him to be constrained by an outdated building regulation system:

The existing bye-law [sic] restricting the height of buildings was framed in 1914 when the population of Melbourne was only about 600,000 and when land values were, speaking generally, well under 50% of their present value, when steel-frame construction, reinforced concrete and modern fire-proofing were in their infancy and the equipment of the Fire Brigade was not what is today. Elevators were slow; some tall buildings – or what is termed ‘tall’ in Melbourne – had been erected, but their construction was old fashioned, their walls thick, their elevators slow, very little was fire-proof and they were veritable fire-traps.⁵²

In the same year, the Building Industry Congress of Victoria appointed a Building Regulations Committee with the task to reorganise into one set of regulations the heterogeneous multitude of construction-related by-laws of the several Municipal Councils of Victoria. In 1938, the Committee completed a draft of the regulation, known as the ‘The Model Building by Laws’.⁵³ This was the first step towards the creation of a standardised code of building set to operate uniformly in the State of Victoria. In 1945

⁵⁰ Barlow et al., 17.

⁵¹ Barlow et al., 17.

⁵² Marcus R. Barlow, “Building Regulations and the Desirability of Increasing the Heights of Buildings in Melbourne,” *Journal of the Royal Victorian Institute of Architects* 29, no. 1 (March 1931): 17.

⁵³ “Standard Building Regulations: the New Model,” *Journal of the Royal Victorian Institute of Architects* 36, no. 4 (September-October 1938): 113-114.

the draft was eventually converted into a new code, the Uniform Building Regulations (UBR).⁵⁴

UBR, Clause 901 and Clause 214

The UBR administered building construction design, activity and processes of approval in the State of Victoria, including the inner city of Melbourne. Matters that were regulated by the UBR included building height, built-form controls and fire-safe construction.

Prescriptive measures for “Fire Resisting Construction”, also known as named as “Type 1” construction,⁵⁵ required, among others, internal structural columns and other structural members to have a minimum fire resistance of 4 hours, and external structures to have minimum fire resistance of 3 hours.

The UBR also administered building design with measures that affected the form and the geometry of the building envelope. Building height was controlled by a number of restrictive measures described under Chapter 9. The opening clause of this chapter, Clause 901, stated:

The maximum building height in respect to any allotment of land shall be a horizontal plan at a height above the permanent footpath level at the centre of the frontage of the allotment equal to one and one-third times the width of the street to which the allotment has a frontage (...).⁵⁶

In effect, the new uniform regulations reaffirmed the pre-existing height limitations already in place in Melbourne since 1914, and which had been under discussion since twenty years earlier. According to clause 901, since the main streets of the Hoddle grid in Melbourne are 99 feet wide, the maximum building height allowed in Melbourne was equal to 99 feet + 33 feet = 132 feet. The limit of 132 feet was in fact an absolute value. Paragraph (d) of clause 901 further clarified that “the amount by which the width of any street exceeds 99 feet shall not be taken into account in computing the maximum building height”.⁵⁷ Some exceptions were awarded for “decorative features” like mechanical

⁵⁴ Uniform Building Regulations (UBR), Victoria, Victorian Government Gazette 87, 28 June 1945.

⁵⁵ UBR, clause 705, “Type 1 – Framed Fire Resisting Construction.”

⁵⁶ UBR, clause 901, “Maximum Building Height.”

⁵⁷ UBR, clause 901.

equipment, parapets, masts and towers. In any case, these exceptions were not allowed to exceed an additional height of 3 feet 6 inches.⁵⁸

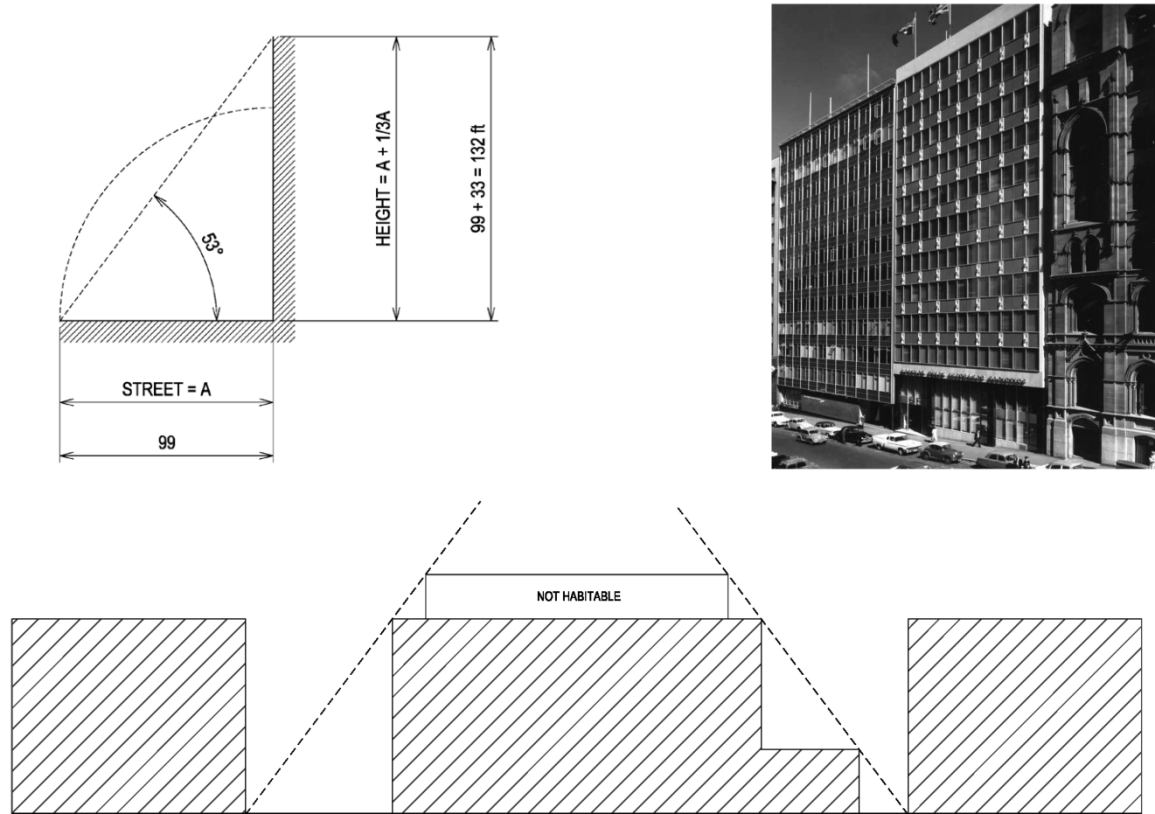


Figure 3.8

Building height limit diagram based on Uniform Building Regulations of Victoria, 1945. Top right: infill office blocks along Queen Street

Notwithstanding the unequivocal framework of restrictions set for building height, the UBR had also an embedded mechanism to cater for proposals of modification of the regulations, which could apply “in the case of any particular building”.⁵⁹ The process of *ad hoc* amendment could be initiated by the owner, the builder or the architect of a building, and it was subject to consideration, and subsequent approval or refusal, of a special committee of referees. The UBR stated the motivations in support of amendment, which could be contemplated when the provisions were considered to “needlessly affect

⁵⁸ UBR, clause 904, “Decorative Features & c.”

⁵⁹ UBR, clause 214, “Power to Modify Regulations.”

with injury the course and operation of business”⁶⁰ or to “defeat the object” of the regulation themselves.

The principle of density

Soon after the first release of the UBR, in an ambivalent context of prescriptive restrictions combined with opportunities for *ad hoc* modification, a discussion about the prescribed height limitations began at the meetings of the Town Planning Special Committee of the City of Melbourne. The debate was prompted by the plans to redevelop a public block of land in the area bounded by Collins Street, Market Street, Flinders Lane and William Street, known as the Western Market Site.

In 1947, following a request of the RVIA, the City of Melbourne launched an architectural competition to appoint the architect of a project of redevelopment on the site.⁶¹ In August of the same year, the Secretary of the RVIA forwarded to the City of Melbourne a resolution of the Institute that asked if, in view of the competition for the Western Market Site, a principle of development based on a “site density basis” could be considered in place of the restrictive height limit of the UBR. The principle suggested by RVIA opened the possibility to conceive a tall building for the site, but the proposal was not accepted by the City of Melbourne.⁶²

Almost at the same time, a report of the City Engineer of the City of Melbourne recommended to the Town Planning Committee that a planning principle based on site density should be considered for the development of the entire inner city. According to this proposal, a principle of density, rather than that of a prescriptive height limit, could be used “if by the provision of yards, courts or set backs, the cubical content of the building is kept down to a bulk not exceeding that which is permitted at present”.⁶³

The architectural competition of the Western Market Site was eventually awarded in 1949 to a scheme comprising five buildings, of which the City of Melbourne committed to build only one as a “height limit” block along Collins Street. The initial Western

⁶⁰ UBR, clause 214.

⁶¹ PROV, City of Melbourne, VPRS 8945/P2, unit 28, Town Planning Special Committee, Meeting Minutes, 3 March 1947, minute no. 3, 1.

⁶² PROV, minute n. 47/3088, 8 [1947].

⁶³ PROV, minute n. 47/3011, 8 [1947].

Market project, subsequently named Hume Square, was however delayed for several years due to financial problems caused by rising building costs.⁶⁴

The redevelopment of the Western Market Area was still on hold in 1955 when the “question of increased building heights for Hume Square” resurfaced on the agenda of the Town Planning Committee. The prospect to review the project with a new “shaft” type of building was proposed and seemed desirable. The Committee decided, however, not to adopt the change to avoid a reimbursement penalty of £50,000 pounds for the winners of the competition. Nonetheless, the Committee on that occasion adopted to maintain confidentiality on the matter and that “nothing should be committed to paper” about the discussion held at the City of Melbourne. At the same time, the Committee instructed that “the City Architect should draw a rough sketch for the development of the building having in mind a shaft type building for the remaining portion of the project”.⁶⁵

In the meantime, the RVIA and the Institute of Engineers, possibly unaware of these internal discussions, continued to exercise pressures and kept writing to the Building and Town Planning Committee proposals to amend the existing height limits.⁶⁶

A more scientific approach

The Western Market Project and the City Engineer proposal had re-opened the debate within Melbourne City Council on building taller in Melbourne, but it was by following private development pressures that the question of height control of the UBR was definitely reassessed publicly. In 1955, the Traffic and Building Regulations Committee of the City of Melbourne received an application from the architects Bates, Smart & McCutcheon. The application included a request of modification of the UBR in order to erect a new office building with a building height of 230 feet. The building in question was ICIANZ House at 1 Nicholson Street. In the first response to the application, the Committee stated to be:

(...) generally in favour of the application being granted and [they proposed] to review the height without allowing any increase in density,⁶⁷ having regard to the more scientific

⁶⁴ PROV, memorandum of the Town Planning Special Committee, “Development of Western Market Site”, [1950-51?].

⁶⁵ PROV, 5 July 1955, minute n. 2, 44.

⁶⁶ PROV, City of Melbourne, VPRS 8945/P2, unit 191, Building and Town Planning Committee, minute 55/4856, 114 [1955].

approach to this matter that has evolved of recent years of which the proposed building under review could be regarded as an example.⁶⁸

Before the final approval was granted, however, the case of ICIANZ was considered at length by the Building Regulations Committee, the Town Clerk, the Building Surveyor, the Chief Officer of the Fire Brigade, the architects and representatives of ICIANZ. The strongest obstacle considered before approval was the “provision of adequate fire fighting facilities and fire prevention methods of construction.”⁶⁹

On 6 July 1955, architect Osborn McCutcheon and two representatives of the ICIANZ attended the Building Regulations Committee in person to respond with explanations on the project, particularly with regard to fire safety concerns. McCutcheon stated that contrary to the position of the Chief Officer of the Melbourne Fire Brigade, fire authorities in other parts of the world had different opinions about fire safety of buildings taller than ladder-reachable height. He then quoted the “classic example [of] the Empire State Building (...) which was hit by an aircraft at approximately the 40th floor [and] when 400 gallons of petrol exploded (...) the resultant fire was confined.”⁷⁰ He then proceeded to illustrate the devices of fire control to be used in the building, including an electro-thermo fire alarm system connected via radio to the Fire Brigade Headquarters, water storage and sprinklers in the basement, two booster pumps and fire-protected steel frame construction. The question of the provision of a general sprinkler system throughout the building was contemplated, but it was not conceded explicitly by the architect as a measure to be included by default in the project.

After further negotiations with the Fire Brigade, approval was granted for ICIANZ House to be built above the height restrictions of the UBR. Thereon, the problem of fire safety at a height above 132 feet was approached in Melbourne by the praxis to install sprinklers only for the floors built above the height limit of 132 feet. The solution was however seen as a risky compromise, as in other parts of the world the provision of sprinklers in tall

⁶⁷ ICI House occupied only over 40% of the site with total a gross floor area of 236,400 square feet. It was approved with a plot ratio of 9 to 1.

⁶⁸ PROV, City of Melbourne, VPRS 8945/P2, unit 138, Traffic and Building Regulations Committee, minute 55/2116, 160 [1955].

⁶⁹ PROV, 197.

⁷⁰ PROV, minute 55/3047, 206.

buildings on all the floors above ground was not unusual.⁷¹ The perceived limitations of this compromise seemed to be a reason of concern at the MFFB. In 1958, fire authorities attempted to correct this hybrid approach proposing to enforce the provision of sprinklers for all floors in buildings taller than 100 feet.⁷²

The praxis of amendment

The rule-breaking proposal of ICIANZ House proceeded on a declared principle of exchange between building height over the limit and return for public benefits, namely public open space at ground floor and parking facilities. The building was an important precedent, as it anticipated a wave of further applications on the same basis. However, the case of ICIANZ House was not an isolated experiment. A more general praxis to amend the UBR for height restrictions had been tested earlier for new office buildings in the city.

The earliest experiments of modification of the UBR occurred on the ‘Little Streets’ of the city. In 1955, permission to build at 77 feet, instead of the 66 feet prescribed by the UBR, was granted for an office building at 533-543 Little Collins Street.⁷³ A year earlier, the Building Surveyor and the Building Regulations Committee approved a request to erect machinery, plant rooms, ventilation equipment and tanks exceeding by 26 feet the prescribed height limit for the new building of the Alliance Insurance at 408-410 Collins Street.⁷⁴ A similar permission for a 20 feet excess in height for lift machinery and ventilation plant was granted earlier to Gilbert Court, at 100 Collins Street.⁷⁵

The modification proposed by ICIANZ and BSM had, however, more substantial repercussions because it implied building usable space, and not just ancillary space, above the height limit. At the ensuing discussions at meetings of the Building Regulations Committee of the City of Melbourne, it was felt that “any increase in the height limit should be allowed only after a basis of density or floor space index has been established”.⁷⁶ Concerns were raised at the City of Melbourne by reports made by “the

⁷¹ Rico Bonaldi, interview, 1 September 2014.

⁷² PROV, City of Melbourne, VPRS 11201, Building Application File no. 32144, Metropolitan Fire Brigade, “Report Relative to the New Building for Shell Co. of Australia, 27 February 1958.”

⁷³ PROV, City of Melbourne, VPRS 8945/P2, unit 138, Traffic and Building Regulations Committee, minute 55/423, 90A [1954-55].

⁷⁴ PROV, minute 54/4254, 22A.

⁷⁵ PROV, minute 54/1824, 350.

⁷⁶ PROV, minute 55/2116, 197.

Press” about the ICIANZ House, which stated that the UBR referees had been given excessive powers to approve modifications of the regulations:

(...) under the ‘modification’ provision of the Regulations, the granting of approval for this building was a major departure from the Regulations which could hardly be covered by the term ‘modification’.⁷⁷

Nonetheless, in the city, the praxis to request a dispensation from the 132 feet height limit on main streets became a norm thereafter. Applications for ‘modification’ of the UBR multiplied, extending from building height matters to new matters of prescription.

Fire-proofing construction methods were also object of disagreement between architects and authorities. In particular, the requirement to have three hours fire rating on external walls was source of contention. In 1958, Buchan Laird and Buchan, the local architects working in joint venture with SOM on the Shell Corner project, requested repeatedly to lower external wall fire-proofing requirements from three hours to two hours. The request was advanced on grounds that the building would use new methods of fire-proofing with sprayed asbestos in lieu of ½ inch gypsum plaster.⁷⁸ Similarly, in 1960 the office of Bernard Evans & Partners, as architects of the CRA Building, proposed, although without gaining approval, to reduce the fire rating of the external spandrels in virtue of a proposed use of asbestos-backed panels.⁷⁹

3.4 Islands of space quality

From the fringe to the Hoddle grid

Colonial Mutual Life [Map 6B, 1]

In 1956, the firm of Stephenson and Turner was engaged to design the new head office of the Colonial Mutual Life Assurance Society (CML). The first scheme proposed was located at the corners of St Kilda Road and Albert Road, on a site at the southern fringe of the city, not far from the monument of the Shrine of Remembrance.

⁷⁷ PROV, minute 55/2116, 197.

⁷⁸ PROV, City of Melbourne, VPRS11201, Building Application File 32144, Buchan Laird and Buchan, letter to the Secretary of the Building Regulations Committee, 25 March 1958.

⁷⁹ PROV, City of Melbourne, VPRS 11201, Building Application File 33755, Bernard Evans and Partners, letter to the Building Surveyor, 15 June 1960.

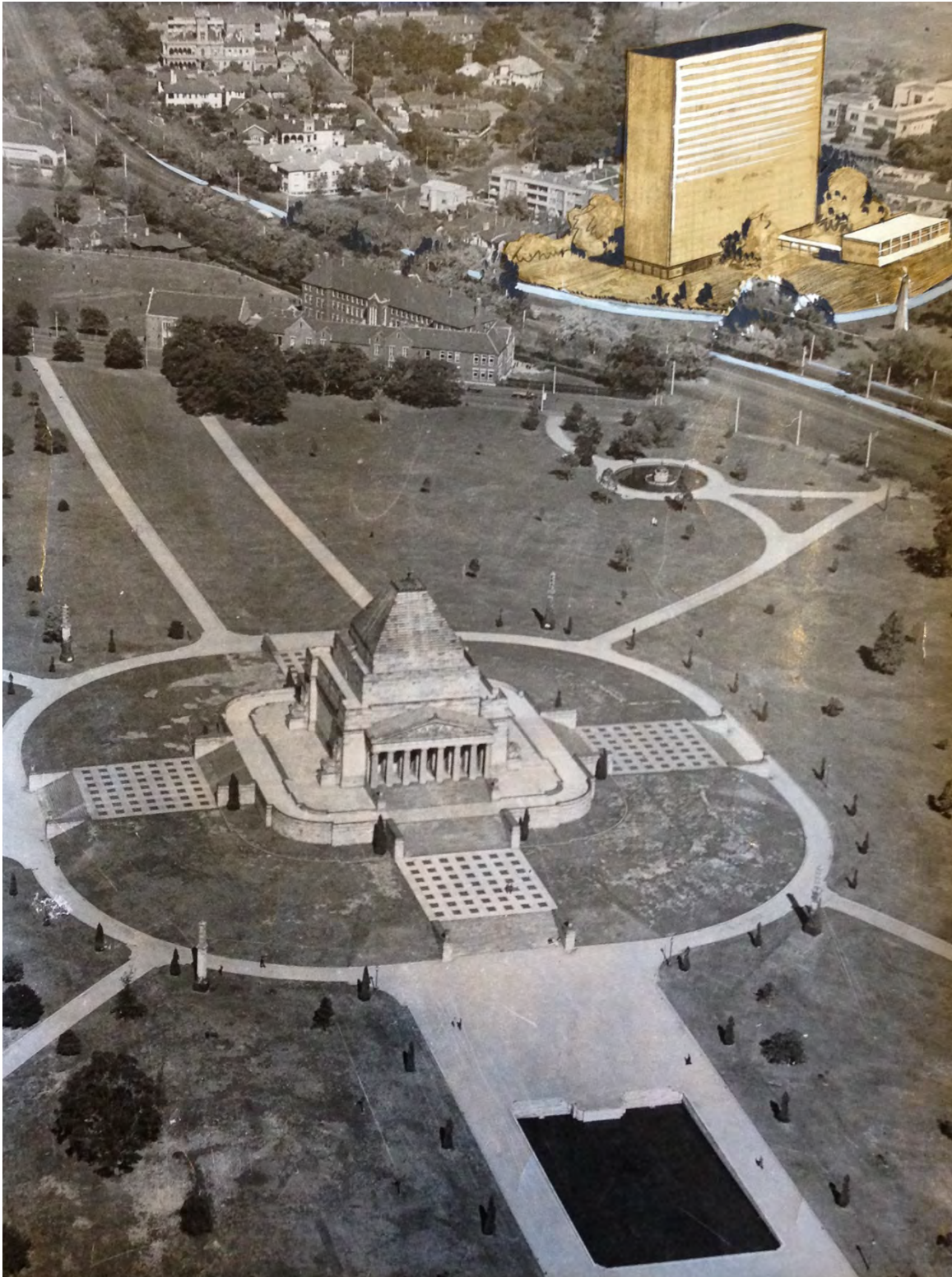


Figure 3.9
Colonial Mutual Life Building, early sketch proposal sited in St Kilda Road, 1956

A feasibility study was completed in July 1956, which compared the St Kilda project and an alternative scheme to be built in the inner city.⁸⁰ The St Kilda proposal was conceived as a side core slab of seventeen floors rising to a rule-breaking height of 200 feet. With regard to the prospect of receiving a dispensation for a non-compliant building height, Arthur Stephenson, the architect in charge of the project, wrote to the client:

It would appear that (...) authorities have no objection to the building being erected to the height suggested, providing we comply with their requirements as to parking and open area. This site would enable us to fulfil these requirements. In order to obtain approval for this limit of height it will be necessary to submit the proposals to the Referees. There is good reason to believe, however, that such an application would be approved.⁸¹

Stephenson and Turner suggested to CML that the new slab-type tower proposed for St Kilda would be the most favourable outcome for the Society. In conclusion of the comparative feasibility study, Arthur Stephenson wrote:

We would respectfully direct your attention to the decided trend in the development of the Head Offices of similar societies in Canada and in other countries (...). This trend towards building within close city range – where car parking is available and, above all, where a garden setting is possible – is very much favoured. That the city property could be developed with advantage is undisputable (...) but (...) we do feel that very special consideration should be given to the St Kilda Road development.⁸²

The General Manager of CML, however, decided to implement the scheme in the central city. The rationale of this choice was based on a preference for centralisation, as a presence in the city was considered by CML unavoidable since “the Society would not be in a position to support two centres”.⁸³

Stephenson and Turner then committed to fulfil the request of their clients with a new building of distinction and quality that “could be recognised as a contribution by the

⁸⁰ SLV, Stephenson and Turner Archives, volume 3278, Stephenson and Turner Architects, “Report on Investigation into Alternative Sites for the development of the Head Office of the Colonial Mutual Life Assurance Society Limited”, June 1956.”

⁸¹ SLV, Arthur Stephenson, Memorandum for Mr R. E. Anderson [Colonial Mutual Life Assurance Society], 8 June 1956.

⁸² SLV, 4.

⁸³ SLV, Stephenson and Turner Archives, volume 3279, Arthur Stephenson, memorandum of interview with Mr Greig, 13 September 1956.”

Society for civic dignity and beauty”; the means to achieve this aim were deemed to be “simplicity, good proportions and the use of good quality materials”.⁸⁴

Air rights

The proposal to build in the inner city, rather than in St Kilda, implied the replacement of the pre-existing premises of Colonial Mutual Life at 316 Collins Street, at the corner with Elizabeth Street. The existing property was a Neo-Romanesque office block of six storeys designed by Edward E. Raht and commissioned by the American Equitable Life Assurance Society in 1897. The Colonial Mutual Life acquired the building in 1925, which in the 1950s was still occupied as the Society’s main headquarters.

In October 1956, Stephenson and Turner enquired about the former Equitable Life Building with the recently formed National Trust, a new authority responsible to comment on the historical value of Australian buildings and monuments. The architects then reported to the client:

As you know, the National Trust has been formed recently with Sir Daryl Lindsay as Chairman and Professor Burke as one of its members. Both these gentlemen with others have viewed the building, and they do not consider that 316 Collins Street has any claim to be regarded as of historical interest nor to have a claim as a National monument. It is an interesting building of its type, but we in this office also share the opinion expressed above.⁸⁵

In February 1957, the Society informed the architects of the decision to substitute their headquarters on the property at 316 Collins Street with a new building.⁸⁶ The site presented some challenges arising from existing rights of way on an adjoining lane, Equitable Place. Stephenson and Turner prepared several schemes and for one of the proposals, the client’s representative responded with enthusiasm suggesting the preferred course of action:

I have been thinking a great deal about the sketch you showed me yesterday of a building consisting of a platform four or five storeys high, surmounted by a tall slab. I must say it appeals to me very much – wether glass *or* stone. (...) I would soon [go] to the Council with that sketch and [present it] as our main alternative to the divided, very limited design

⁸⁴ SLV, Stephenson and Turner Architects, “Report on Development of Melbourne Head Office for the Colonial Mutual Life Assurance Society Limited.” [1956].

⁸⁵ SLV, Stephenson and Turner Architects, letter to R. E. Anderson, 15 October 1956.

⁸⁶ SLV, Arthur Stephenson, memorandum of meeting [with General Manager and other executives of Colonial Mutual Life], 28 February 1957.

to which we would be restricted if we cannot build over Equitable Place. With no in-between plan, the contrast would be striking.⁸⁷

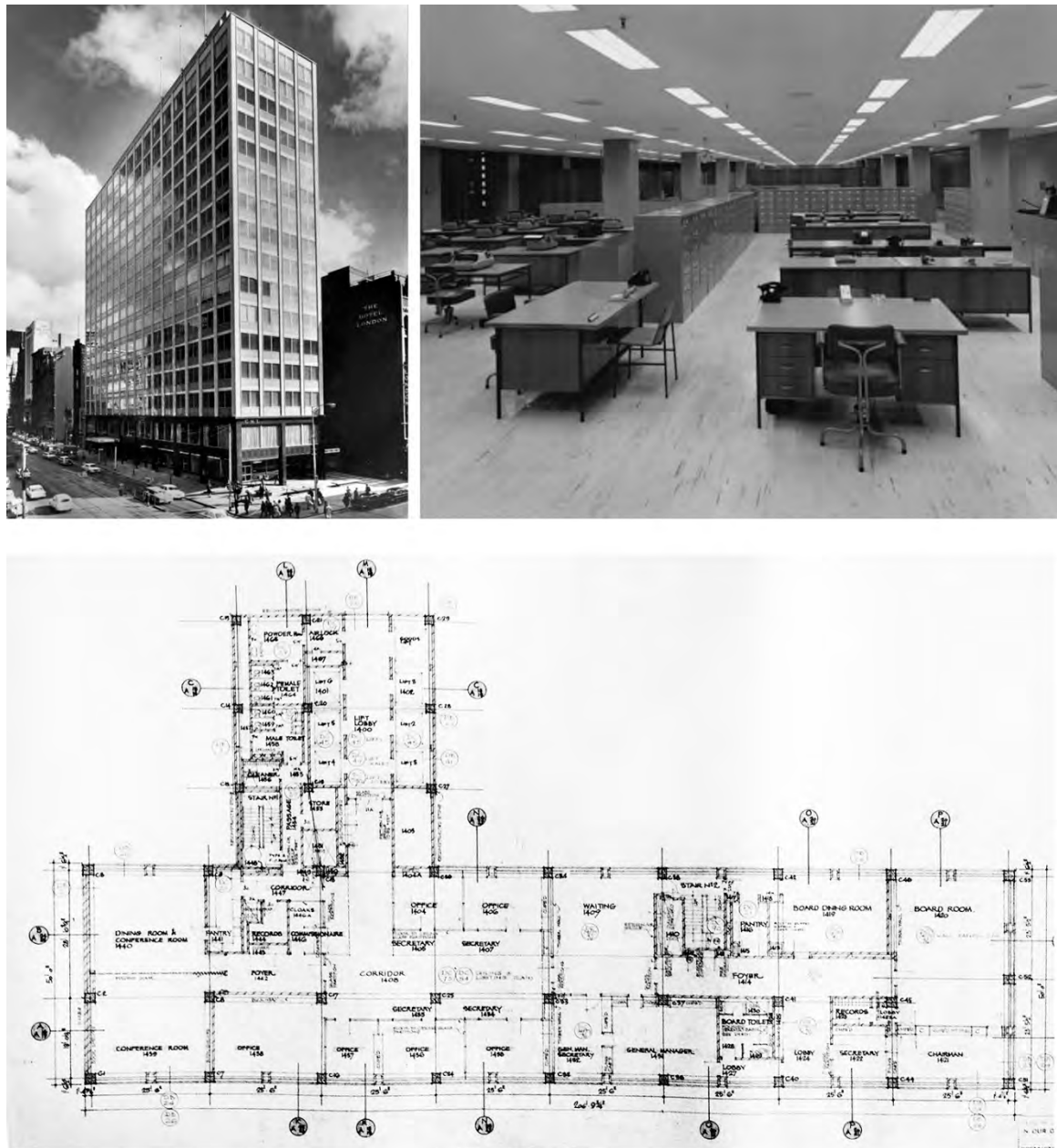


Figure 3.10

Colonial Mutual Life Building, 308-334 Collins Street, 1959-63; external view, internal view and level 14 floor plan

The tall slab scheme was based on the consolidation of several properties already owned by CML and, given the Society's special requirement to have six larger floors of at least

⁸⁷ SLV, E.W. Curtis [Administrative Secretary of the Colonial Mutual Life], letter to Sir Arthur Stephenson, 8 March 1957.

15,000 to 20,000 square feet, it rested on the proposal to use air rights by building over two rights of way. In a report submitted for consideration of the Town Planning Committee the architects stated:

We respectfully suggest that it is to the City's advantage to encourage such development which can only be realised in city blocks of approximately 22,000 square feet and upwards of ground space. You will appreciate that it is necessary to build over such rights-of-way where practical if such buildings as envisaged are to be constructed. If relief can not be obtained from the present restrictions the development of large scale buildings in keeping with world wide trends will be strictly limited by the inherent difficulties in securing sites of sufficient size, especially where buildings are divided by right of way.⁸⁸

In November 1957, following the approval of the Public Works Committee and a letter of support sent by the Mayor to the General Manager of Colonial Mutual Life, the proposal was finally approved by the City of Melbourne to develop the corners of Elizabeth and Collins Street with a tower exceeding the height limit, and with a podium of larger floor plates and by building over right of way in two public lanes.⁸⁹ In 1960, when the ten months demolition of the existing Equitable Building started, passers-by observed with regret and surprise the demise of the older landmark. A dis-heartened commentator of architecture noted:

(...) the old C.M.L building is no longer economical. Its beautiful marble and cedar interior must go. The 25-feet high ceilings and empty unusable lobbies represent space which is desperately sought after in this restless period of Melbourne's growth.⁹⁰

The ideal plan

The city slab of Colonial Mutual Life was completed in 1963, and shared evident similarities with ICIANZ House, both for its configuration in plan – a similar slab with detached core - and for size and dimensions (similar floor plate size and overall net lettable area). The slab width of 48 feet was the fruit of a search for the “ideal plan” established with a close collaboration between the architects and the client.⁹¹ Tabling information gathered from American sources, the client instructed specifically the designers in order to meet the space planning and operational workflows of the Society.

⁸⁸ SLV, Stephenson and Turner Architects, letter to the Town Clerk, Melbourne City Council, 18 September 1957.

⁸⁹ SLV, Stephenson and Turner Architects, letter to J. L. Greig [General Manager of Colonial Mutual Life], 27 November 1957.

⁹⁰ John Tyrrell, “A last look ...” *Architecture Today* 2, no. 6 (April 1960): 13-14.

⁹¹ SLV, Stephenson and Turner Archives, volume 3279, Stephenson and Turner Architects, memorandum of meeting, 9 December 1957.

Similar considerations and conclusions were reached to establish the most desirable spacing of columns. The slab was oriented along Collins Street to provide maximum light on the northern and southern aspects of the slab, and the core was detached on the northern side of the slab to allow a future expansion on adjoining sites, which were owned by the Society along Little Collins Street. The ground floor was developed with a retail tenancy and an arcade to favour pedestrian circulation. This owner-developed building was also seen as an advertising opportunity for the Society. By taking advantage of the 251 feet high service core, an observation gallery was included to be “illuminated at night in colour” and conceived as “a prominent additional landmark to Melbourne’s skyline”.⁹²

Feltex House

In the mid-1950s, the Felt and Textiles Company of Australia (Feltex) decided to build its headquarters in East Melbourne, at the corners of Nicholson and Victoria Streets, on the eastern fringe of the inner city grid. The site was a block of land of almost 14,000 square feet consolidated from three different parcels. Once completed in 1959, Feltex House stood out in Melbourne for an innovative typological approach that combined geometric rigour and workspace flexibility.

The plan of the office block, designed by local architect Guilford Bell,⁹³ was a perfect square that measured exactly 80 feet by 80 feet. The internal space consisted of four sides of uninterrupted, 24 feet deep column-free space. Each side was equal to the other with regards to internal quality and flexibility of space. At the same time, two sides of the square boasted front of house exposure and character as the main street frontages of a corner site. Workspace was served by a perfectly square and central service core 28 feet by 28 feet wide with two back-to-back stairwells, one fire-isolated and one open for inter-floor circulation. With this arrangement, the floor space of 5,600 net square feet outperformed in efficiency most contemporary office buildings, with a ratio of net to gross floor area of 87%.

⁹² SLV, Stephenson and Turner Architects, memorandum of meeting, 9 January 1958.

⁹³ Philip Goad, “A Very Private Practice: the Life and Work of Guilford Bell,” in *The Life Work of Guilford Bell*, edited by Leon van Schaik (Melbourne: Bookman, 1999), 115.

This small owner-occupied building was initially conceived as a twelve-storey tower, but it was completed only with four levels of office space and a ground level surrounded by a colonnade, which included the lobby, some mechanical rooms and display cases of Feltex products. An opportunity for future vertical extension was left open by a robust core concrete structure, which protruded through the roof giving access to an open terrace. This opportunity, however, was never realised, thus possibly determining the fate of Feltex House to a short-lived existence terminated by demolition in 1986.⁹⁴

Feltex House was an office building of pure geometric form, with a central core and quality office space all-round with “glass walls on four sides”. The boldness and novelty of approach of Feltex, was celebrated on the front cover of *Architecture Today* in 1959, where the building was described as a rare example of the successful integration of “functionalism and artistry” between client and architect.⁹⁵

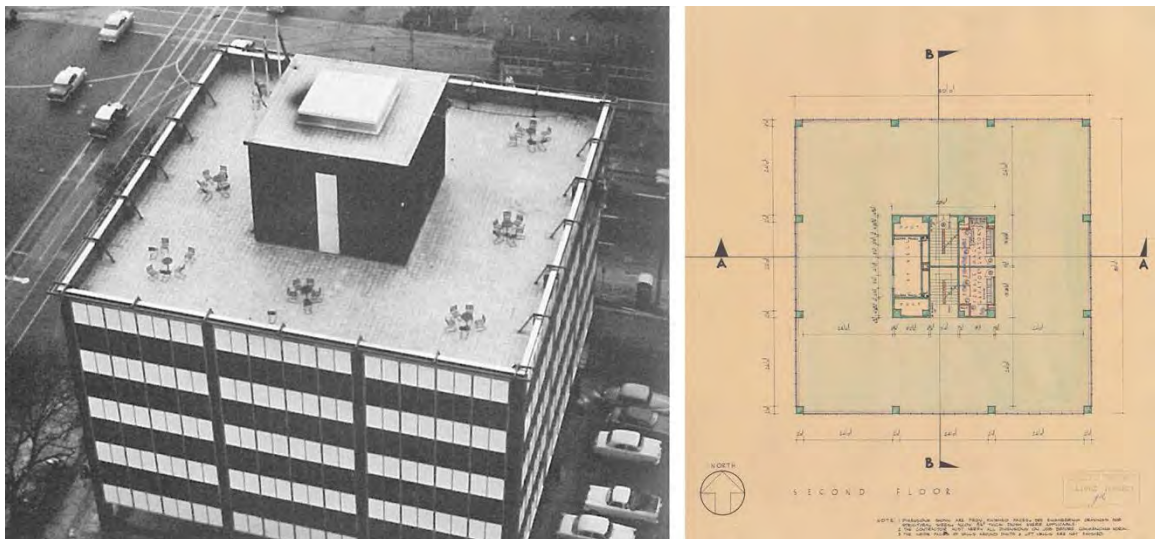


Figure 3.11

Feltex House, 8 Nicholson Street, 1957-59; aerial view and second floor plan

State Government Offices [Map 9B, 36]

In 1962, the State of Victoria launched a competition for the design of the new State Government Offices and called twelve architectural firms to participate. The project was

⁹⁴ PROV, City of Melbourne, VPRS 8945/P2, unit 228, Development Approvals Committee, application no. DP/0329, 10 September 1986.

⁹⁵ “Glass Walls on Four Sides,” *Architecture Today* 1 no. 11 (September 1959): 18-23.

to be completed in two stages with the buildings expressly required to be “fully air conditioned”. The brief stated:

Whilst extravagance cannot be entertained, competitors are allowed to use their discretion in submitting a design of character and dignity associated with the existing Treasury Building and surrounding architecture.⁹⁶

The site was outside the city grid, in the immediate vicinity of the eastern end of Collins Street, where the axis of the street concludes with the Renaissance Revival Old Treasury Building, completed in 1862. The winning proposal was submitted by the Melbourne based firm of Yuncken Freeman as a scheme that consisted of two office blocks: one low-rise and one high-rise.



Figure 3.12

Government Offices, Treasury Place; winning competition scheme, 1963

The tower was completed in 1969, during the second stage of the project. It was free-standing with sixteen storeys and included one basement and one level in a sunken courtyard. The low-rise block of six-storeys was lower than the Old Treasury and the high-rise block tower of the State Government Offices faced Mac Arthur Street surrounded by a triangular plaza. The tower was deliberately offset from the axis of Collins Street to avoid visual interference with the monumental termination of the street.

The footprint of the taller tower was an almost perfect square of 93 by 90 feet with a central service core. The core, being an elongated rectangle, created two spacious side zones of 36 feet depth on the eastern and western sides of the floor. Space depth was worked out to accommodate the space planning requirements given by the Government, and allowed the provision of cellular offices along the façade backed by a deeper open

⁹⁶ “State Government Offices,” *Architecture in Australia* 59, no. 4 (August 1970): 643.

space normally occupied by typing pools and secretaries.⁹⁷ The core was split symmetrically with two lifts on each side. The lift lobby worked efficiently serving also as an interconnecting path between the two zones of deeper open space.

The tower of the State Government Offices was, like Feltex House, one of the first examples of a new office building typology, the square plan office block. The similar shape of the two buildings disguised, however, some fundamental differences of the interior space, which derived from differences in the height of the two buildings. The State Government Offices had a larger gross floor area of 8,370 square feet opposed to the 6,400 square feet of Feltex. The tower of the State Government Offices was efficient with a net lettable area of 6,600 square feet and 85% gross to net ratio. However, the elongated core, required by four passenger lifts, created two zones of barely usable space. This limitation was resolved by Yuncken Freeman by giving priority to two deeper zones at 36 feet, instead of the shallower 24 feet deep space of Feltex House, which inferred that the value of column-free deep space was of overriding importance over a mere quantitative efficiency of lettable area.

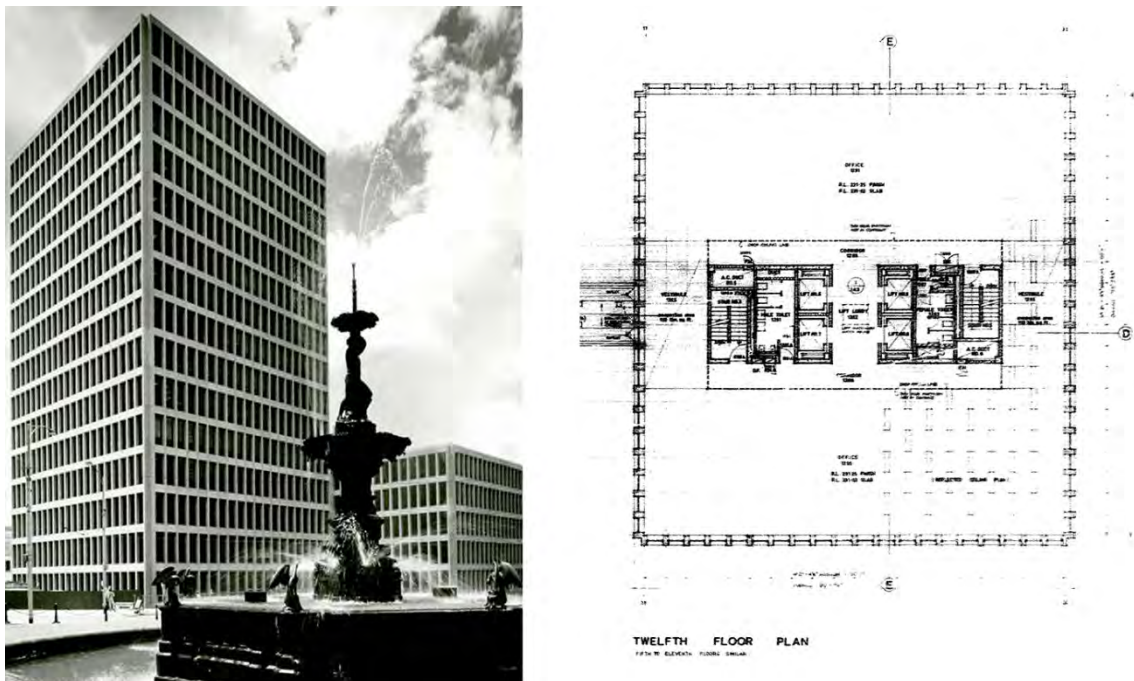


Figure 3.13

Government Offices, Treasury Place; external view and level 12 floor plan

⁹⁷ Yvonne von Hartel, interview, 19 November 2013.

The two buildings shared also the characteristic of being located on the fringes of the Hoddle grid, where the new typology of office space open on four sides could be implemented more easily on land unencumbered by contextual impediments, which were more typical of the inner city grid. This building typology, however, eventually reached the inner city in the mid-1960s in the western side of the business district, on a block of land adjacent to Shell Corner.

ACI House [Map 1D, 28]

In September 1964, the manufacturing company Australian Consolidated Industries Operations (ACI) submitted application to erect new headquarters on a mid-block property at 546-560 Bourke Street. The land was a lot of 37,800 square feet that was initially divided into two parcels by a secondary street, Mort Lane, and occupied by two buildings used as warehouses and offices. In 1964, ACI negotiated with the City of Melbourne the closure of Mort lane, which had virtually split the site in two parts. In return, the City of Melbourne obtained a widening of Goldsbrough Lane, another secondary street that ran along the western side of the property. The new combined property cut through the entire 313 feet depth of the block with a frontage of 121 feet on Bourke Street and Little Bourke Street at the rear.

In 1964, following a praxis consolidated by many precedents, ACI applied and obtained no objection for a modification of clauses 901 and 903 of the Uniform Building Regulations in order to build the top parapet at a height of 198 feet above Bourke Street and for a further additional height due to lift overruns and mechanical room that reached up to a top of 203 feet.⁹⁸

ACI selected for the design Melbourne-based architects Buchan Laird and Buchan, chosen presumably for the familiarity of the firm with the location of the project and for their previous experience on tall office building developments. Buchan Laird and Buchan collaborated with SOM as local architects of the American designed Shell Corner, the building that stood on the adjoining site at the eastern boundary of the property. ACI built with the aim of using the building as their premises and, as a leading manufacturer

⁹⁸ PROV, VPRS 8945/P2, unit 194, Building and Town Planning Committee. Application n. MCC 1109, vol. 194 [1962-64].

in the Australian building market, used the new headquarters as an opportunity to promote, as long as practicable, the company's products.

The plan of ACI House was a perfect square of 90 feet, rigorously planned on a square module of 4 feet 10 inches and it had a main floor space depth of 29 feet on the southern and northern sides and 20 feet on the eastern and western sides. The floor plate had 6,900 square feet of net lettable area of column-free space on four sides. The space wrapped around a rectangular core with three lifts and two diagonally opposed fire isolated stairs. The lift lobby was centred in the middle of the core, where it interconnected from one side to the other of the floor plate and was predisposed for an efficient subdivision of the floor into multiple tenancies of equal size.

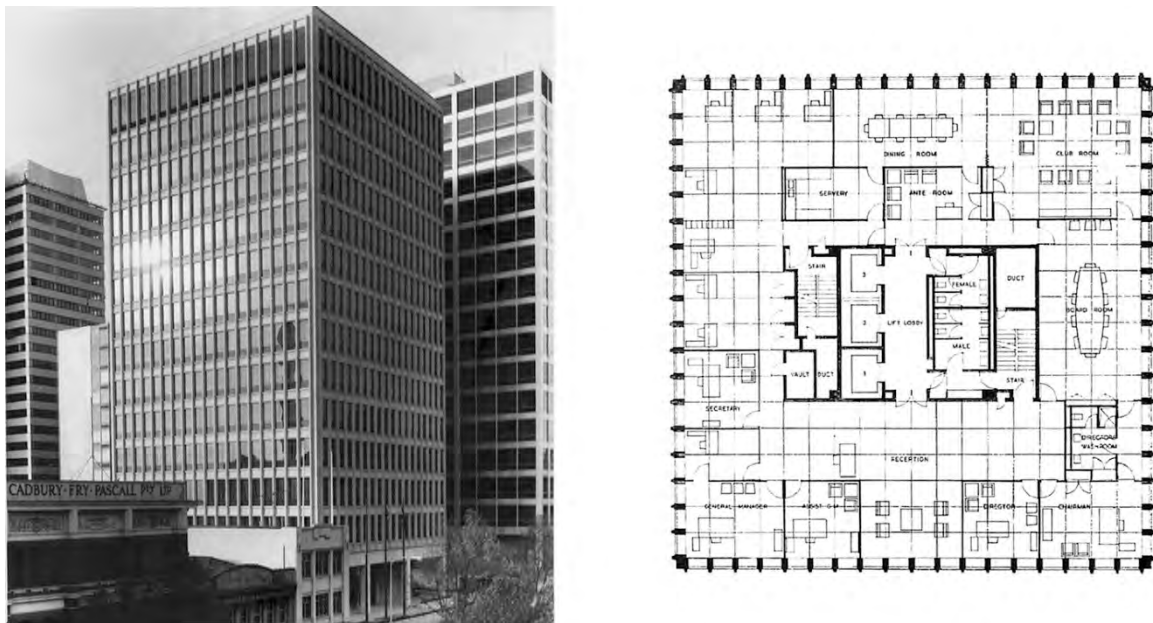


Figure 3.14

ACI House, 546-552 Bourke Street, 1964-66, external view and executive floor plan

The square tower hit the ground with a colonnade of 12 columns creating a recessed shopfront line at ground floor where the lobby and part of the company's office space took place. In section, the tower reached the underground with a car park on three levels. Above ground, 12 levels of office accommodation, including a caretaker's flat, were topped by a double-height attic of mechanical plant. ACI House was set back 23 feet from Bourke Street and occupied only the southern part of the property on Bourke Street;

the northern part of the site was used as car park, leaving, essentially, large part of the land underdeveloped. In 1968, ACI House received a Victorian Chapter citation for urban design of the Royal Australian Institute of Architects (RAIA) Architectural Award. The journal of the Institute, *Architect*, reviewed the project describing it as “an elegant white addition to Melbourne’s fortunately growing family of ‘island’ structures”.⁹⁹

Conclusion

Between 1955 and 1965, the Central Business District of Melbourne changed due to the rise of a new generation of multi-storey office buildings. In the greater part, the construction of these buildings was prompted by corporations desirous of building new headquarters for owner-occupation. Among these corporations, insurance companies played a conspicuous role, as direct occupiers of the majority of space in their own buildings and also, although less often, as speculative land owners willing to make long-term real estate investments. Initially, this wave of construction activity coalesced chiefly along two streets, Collins and Queen Streets, which historically had established a reputation as the preferential address for tertiary business activity in the city. In the already densely developed streetscapes of these streets, new office blocks rose often as substitutions of older office blocks built in the late 1800s. Development activity spread to other areas of the city, westwards along Bourke and William Streets and along Lonsdale Street. Initially, a modest and pragmatic approach of redevelopment by small substitution was prevalent, which affected parcels of land not exceeding 10,000 square feet. The intensity of use of the land, as indicated by the total amount of net lettable area, was in the order of maximum seven times the area of the site. (See Appendix A, table A.2)

By the end of the 1950s, a new trend of development emerged, which consolidated land in order to erect larger office buildings. The first operation of large consolidation of this kind in the city was on the fringes of East Melbourne with the construction of ICIANZ House. Land was consolidated into a parcel of approximately 25,000 square feet, where a total of more than 180,000 square feet of lettable area was provided by a single building. By the early 1960s, this model of development was transplanted at the core of the inner city, in prominent sites on Collins Street. The CML Building, for example, had the same total amount of office space produced by ICIANZ House, but was developed on

⁹⁹ “A.C.I. House,” *Architect* 2, no. 3 (July-August 1968).

consolidated property of 21,600 square feet, which, after negotiation with the City of Melbourne, had benefited from a concession to build over public laneways.

The appearance of this larger model of development within the city grid expanded the trend of substitution of older buildings in a way that condemned to oblivion larger monumental, heritage-laden office block buildings of the 1890s. This trend towards larger and widespread operations of redevelopment, which had potential to reconfigure the city at large, was exemplified by the contemporary development of all parcels of land at the four corners of the intersection of Bourke and Queen Streets.

This growth of owner-occupied commercial building activity reinvigorated a dialogue between architects, authorities and developers about tall buildings and regulations, which had been present in the city at least since the 1920s. In the 1950s, views were shared - among architects, developers and public authorities alike - that opportunity should be given to allow office building to be 'taller' in the city. This debate implied the ensuing necessity to supersede building regulations of recent introduction (UBR, 1945), which being based on a prescriptive control of building height, set an absolute building height limit at 132 feet. In the unfurling of this debate, public authorities did not merely play a passive role as custodians of the regulations. To the contrary, in the mid-1950s, the City of Melbourne initiated, in autonomy, a discussion to introduce a new principle of development set on a basis of 'site density', to be tested in view of a major development on dismissed land of public ownership, the Western Market Site. This process of review of built controls was then accelerated by private interests, which the City of Melbourne encouraged in order to set a new exemplar for future developments for the rest of the city.

The optional modification of height controls was deemed as a form of public interest by planning authorities in exchange of benefits arising from the provision of public open space at ground level and car park facilities. A tacit, but not secondary, public benefit consisted in the opportunity to multiply by many times council rates revenue in virtue of a taxation system based on the value of net lettable space. The call into question of prescriptive height limits in the inner city engendered thereon the praxis of *ad hoc* assessment of tall building projects. In inner city Melbourne, tall office buildings thus became a reinforcing agent of the principle that regulations, should not – as made explicit by a clause of the UBR - interfere with the 'operation of business'.

The novelties that sought to improve the commercial use of space in the inner city through amendments of the regulations were paralleled by a process of experimentation in building typology. While developments on smaller inner sites struggled to attain the most desirable outcomes for workspace quality, new paradigms were determined by seminal buildings on the fringes of the city or in less prestigious addresses of the Hoddle grid.

Pressures to introduce changes to building regulations were amplified by the need for testing new typological models of office design, which stemmed from new ideas of space quality based on flexibility, modular coordination and column-free open space. The implementation of these spatial concepts relied on the existence of development rights in land parcels of adequate size, and which, ideally, should be free from public encumbrances that created ‘vacuums’, or - in other words - inefficient irregularities of the site that prevented the fine-tuning of the ‘ideal plan’, the most efficient floor plate design for the operation of business.

Three typologies emerged in the city during the decade 1955-65: (1) the side core slab, (2) the squarish shaft, and (3) the square tower on an ‘island’ site. All three models shared a leitmotif: the quest for column-free space against the problem of the mutual configuration of service core and floor plate.

The paradigm *par excellence* of the side-core slab was ICIANZ House, which juxtaposed and separated as ‘male and female’ the service core from the served space – an elongated rectangular plan with aspect ratio of one to three. The archetypical success of this model is evident by a pattern or recurrence, which anticipated and followed ICIANZ, with Hume House, the CML Building and HC Sleigh. In 1964, HC Sleigh took the model to its formal high point with a floor plate rid of internal columns, which was rewarded by the market with record-breaking rental rates.

The second paradigm, a monolithic tower - or ‘shaft’ - of squarish footprint, was tested in the more eloquent manner at Shell Corner, where the core was set aside but left inscribed within a monolithic short rectangle of rigorous proportions and modular control of structure, façade and services. The prototypical attributes of this model, exemplified in Melbourne by the American design input of SOM Francisco, were easily receptive for

local designers, as shown by the less successfully coherent outcome of the CRA Building in Collins Street.

The building types of the slab and of the shaft were complemented by another type, which emerged during the decade 1955-65, albeit in an embryonic state of experimentation. This type was a monolithic and perfectly square tower with column-free space served by a centre core. Three projects demonstrated, with subtle variations on the theme, that new office design with column-free and all-round frontage exposure was achievable.

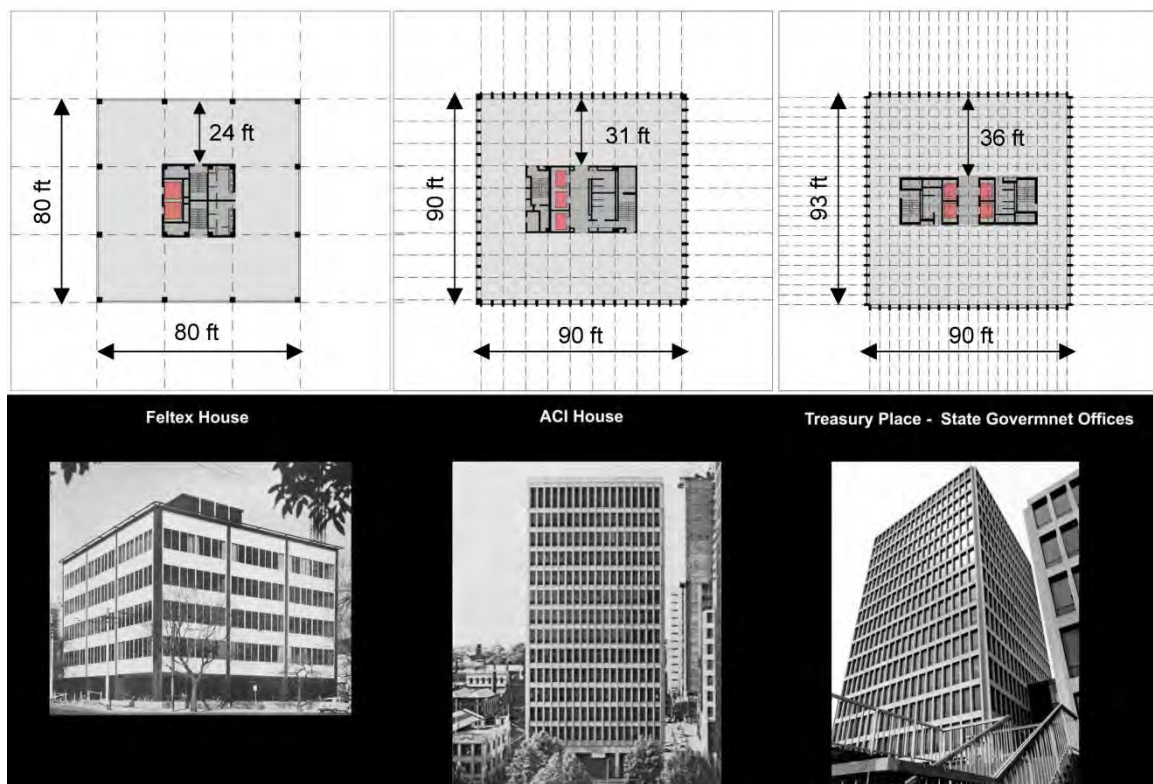


Figure 3.15

Feltex House, ACI House and State Government Office, comparison of typical floor plans

Two of these projects, Feltex House and the tower of the State Government Offices showed, like ICI House, that in comparison with the constrained conditions of the inner city, these new models could be more easily experimented upon in East Melbourne. Feltex House, in fact, occurred almost in synchrony of time and place with the headquarters of ICIANZ. The tower of the State Government office, although conceived in the early 1960s, took longer to materialise in the skyline in 1969, but it was publicised

well before its completion. Between 1964 and 1966, as a result of a significant exercise of land consolidation in Bourke Street, ACI House was the third tower of the square plan type to be conceived in Melbourne and it would be built in the relatively less prestigious, western district the city grid of the Central Business Area, on a site adjacent to Shell Corner.

Feltex House, State Government Offices and ACI House initiated thus a new typological trend in office building design that combined open column-free space with a new formal synthesis that resolved the location of the core as a component within the building itself, rather than as an expressed appendix of support on the side.

In the three forms of slabs, squarish shafts and with the more monolithically bold concepts of free-standing square towers, these buildings were pace-setting and mostly owner occupied buildings that stood out in contrast with the office space stock inherited before World War II. These buildings provided new design benchmarks, which translated into better rental rates. By means of land consolidation and increased utilisation of the land, they also multiplied land tax revenues for the City of Melbourne. The size of the typical floor plate, the overall amount of net lettable area of the building, and the provision of open, possibly column-free space continued in the following decade as the key design inputs for the expansion of office space quality in the city.

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Chapter 4

Expansion (1965-1980)

The rise of the square tower

(...) experience suggests that human reasoning is no more logical on matters of building height than in other fields of human endeavour, particularly as height is so closely linked to the concept of prestige. To achieve prestige it is frequently considered desirable to build higher than anyone else. This means consolidating titles to produce larger areas of land to enable buildings to go higher within the limits of existing plot ratios. One definition of a prestige building is one that returns 7 per cent instead of the usual 10 per cent.

Harry Wexler, 1971¹

In the second half of the 1960s and during the 1970s, the notion of space quality that crystallized in the first paradigms of tall office building design, with maximised views, column free space and all-round views, was further reinforced by a growing awareness of the pivotal role of efficiency in design.

In 1971, Harry Wexler, a quantity surveyor from Melbourne who served as the President of the Victorian Chapter of the Australian Institute of Quantity Surveyors (AIQS), discussed the issues of economics of construction and design efficiency of Australian high rise with a paper presented to the Australian Building Owners and Managers Associations (BOMA). Wexler, first of all, made remarks related to the use of land:

The price of city land reflects its development potential. In other words the purchaser is really buying plot ratio. (...) Although the plot ratio utilised is almost invariably the maximum allowed, the optimum height and shape of a building is not achieved simply by covering the whole site up with a tower block of maximum height.²

The leader of the Australian quantity surveyors discussed also the attribute of 'prestige' about height, stressing that matters of economic return associated with building height did not evolve - at least in Australia - as a matter of self-evident truth:

¹ Harry Wexler, "The Economics of Construction Cost of High-Rise Buildings in Australia," *Building Economist* 10, no. 2 (June 1971): 2-5. The article was based on a paper presented at BOMA in Perth and Melbourne.

² Wexler, 2.

Developers of early high rise buildings found – sometimes to their surprise – that tenants up aloft were prepared to pay higher rents so that a high building / high rental relationship was established.³

Wexler continued describing the design parameters needed to achieve ‘prestige’ in tall office buildings. The ratio of efficiency of net to gross area could be “misleading”, unless it was “determined primarily by floor size and shape and by core design”.⁴ Then, he gave indication that, despite enduring talks about “landscape” design trends, a “general consensus” in Australia had set key design decisions concerning the size of floor plates (10,000 to 12,000 square feet), floor plan shape (a square plan of 120 feet) and distance between the envelope and the service core (40 feet deep space). These factors were interrelated in the design process: height, floor plan shape, size and span were spatial parameters that affected, prestige, flexibility, economics and construction.⁵



Figure 4.1
Melbourne, aerial view, 1972

³ Wexler, 2.

⁴ Wexler, 2

⁵ Wexler, 2

This formal ‘consensus’ on the architecture of prestige tall office buildings materialised in the CBD of Melbourne at the turn of the 1970s, where more space for white collar employment was allocated by planning authorities, at the expense of other sectors of business activity, such as retail and manufacturing.

The growth of office space that started in the second half of the 1950s continued and increased in the CBD until the end of the 1970s. Between 1966 and 1967, office net lettable area in Melbourne CBD was about 1,500,000 square metres. By 1972, the total floor space in the CBD had grown by another million square metres. White collar employment, however, did not grow at the same rate, and in fact, from 1967 to 1972 it declined. [See appendix C, tables C.2, C.3]

From the mid-1960s onwards, demand for office space was subject to stronger market fluctuations than in the earlier decade. Sudden growth was intermittent, halted by collapse of the mining sector in 1970 and followed by a second burst of supply, which after the peak of 1972, and came to another halt in 1974. (See appendix C, table C.1) Despite warnings of an office “glut”, another wave of office buildings followed between 1975 and 1978. Then, in 1979, large commercial construction activity almost disappeared.⁶

From the mid-1960s onwards, between 80% and 90% of Melbourne’s entire office stock was located in the CBD. Another office district was located along St Kilda Road, but this accounted for less than 20% of the entire market.⁷ In 1972, the CBD had almost 2.4 million square metres of gross office space.⁸ After 1972, office floor space kept growing less steeply and reached almost 2.9 million square metres of gross floor area in 1977. [See appendix C, table C.2]

Private commercial and government offices absorbed an almost equal share of this space, but private offices, overall, prevailed. Growth of the private half was driven by banking, insurance, professional services, manufacturing services and transport and

⁶ “Glut of office space,” *Architecture Today* 15, no. 1 (February 1973): 9; “Too many offices,” *Architecture Today* 15, no. 2 (March 1973): 5.

⁷ Richard Ellis Sallmann & Seward, “Feasibility Study and Market Analysis,” Collins Street Development Plan, 1971, 12.

⁸ City of Melbourne, *Report on the 1977 Central Business District, Floorspace and Employment Survey*. (Melbourne: City Strategic Planning Division – Technical Services Department 1983), 108, 112.

communication services. Even during the period of less pronounced supply, between 1972 and 1977, space for these activities grew more than 20%.⁹ In the same period, government office space, driven by Commonwealth Government and other public agencies, increased by more than 30%.¹⁰

Between 1965 and 1978, tall buildings were the primary catalysts of office space production in the CBD. According to a study prepared for the Melbourne's Strategy Plan, in 1966, the total space for office use of the CBD was estimated to be 1.2 million square metres.¹¹ A share of approximately 15% of this space was produced by tall buildings during the period 1955-1965. In the skyline of post-1969, only a minority of these buildings could be considered "tall", given that many had heights inferior to 60 metres.

According to the Strategy Plan, in 1972, the CBD had a total net lettable office floor space of 1.6 million square metres.¹² By that time, almost a quarter of this space was absorbed by tall buildings completed between 1965 and 1972. In 1972, according to the director of Baillieu Allard Real Estate, the yearly supply of net office space was approximately 150,000 square metres.¹³ Approximately 125,000 square metres of this space were concentrated in five tall office buildings completed during the year.

After the mid-1960s, a rapid increase in office space in Melbourne's CBD was accompanied by a tendency to concentrate commercial space in clusters of tall office buildings. In fact, tall office buildings were the chief driver of high-rise density, municipal revenue and economic and civic centralisation of the city. From 1965 onwards, the skyline of the CBD was changed by unprecedented large oscillations in the supply of floor space and change was, most of all, due to the construction of many new monolithic office towers.

⁹ City of Melbourne, 109.

¹⁰ City of Melbourne, 116.

¹¹ Interplan and City of Melbourne, *Strategy Plan* (Melbourne: Melbourne City Council, 1974), 53.

¹² Interplan and City of Melbourne, 53.

¹³ "Melbourne office market," *Architecture Today* 14, no. 9 (October 1972): 9.

4.1 The slab, the shaft and the square tower

Typological inertia and new models

Private and public slabs

In the late 1950s and early 1960s, buildings like Hume House, ICI House, the Colonial Mutual Life Building and HC Sleigh Corner in Queen Street, had established the typological paradigm of the slab with side core. This type was suitable for the fringes of the CBD and for the inner city grid alike and, in the second half of the 1960s, it continued to prosper in inner city developments. While the first generation of office slabs was commissioned by private enterprise, the second was driven also by investment in the sector of public administration.

The redevelopment of the Western Market Site eventually started in 1962, with the construction of the headquarters of National Mutual Life Centre [Map 6C, 23]. Setting an important precedent of large scale urban design in the inner city, the project was a free-standing tower slab with a generous forecourt sited on 68,900 square feet of public land. The tower slab of 220 by 72 feet was surrounded by an all-round sun-breaking balcony. The lift lobby and the service core were located asymmetrically as a block on the western end. Due to a long exit travel distance from the eastern end, a secondary fire-isolated stair was provided at mid floor plate - a solution previously adopted in other slab buildings in Melbourne, including ICI House and the Colonial Mutual Life Building. The tower had an L-shaped section with larger floor plates on the lower levels built to allow for a foreseen vertical extension. When completed in 1965, the National Mutual Life Centre had a total net lettable area of 269,000 square feet and it was, by far, the largest office development in the city at that time. The asymmetrical core located at one end was a typological novelty that presented a major limitation; it was inefficient for the internal subdivision into separate tenancies of the rather large 10,800 square feet floor plate.¹⁴

Between 1965 and 1969, the side core slab continued to be the model for office buildings commissioned by public companies and authorities. Aviation House in Queen Street [Map 2D, 27],¹⁵ Communications House [Map 1D, 35],¹⁶ the SEC Building [Map

¹⁴ John Davidson, interview, 28 November 2014.

¹⁵ "Aviation House, Melbourne," *Constructional Review* 39, no. 7 (July 1966): 24-26.

5D, 34],¹⁷ and Customs House in William Street [Map 5D, 33],¹⁸ and the two large slabs of the Gas and Fuel Headquarters in Flinders Street or Prince's Gate [Map 7E, 26],¹⁹ belong - among others - to this group of inner city rectangular towers. The end-core type, similar to the National Mutual Life Centre, was used by Government architects for the Reserve Bank in Collins Street [Map 8B, 25].²⁰

The side core slab continued in private projects until the early 1970s. The speculative development of 500 Collins Street [Map 5B, 43] shared similarities - and limitations - of some contemporary projects in Williams Street, like Customs House and Communications House. While the typical slab of the 1950s was elongated in plan, with an aspect ratio of 2.5 to 1 (Hume House), 3 to 1 (ICI House, HC Sleigh Corner), or even 4 to 1 (Colonial Mutual Life), the slab of the late 1960s was shorter in plan with an aspect ratio of less than 2.5 to 1 (Customs House) and even down to 1.5 to 1 (Communications House). The shortened slab of 500 Collins had, like most of these slabs, the internal floor space punctuated by columns at mid-span.²¹

Unobstructed, column-free space - like at HC Sleigh Corner - was key at Eagle House at 473-781 Bourke Street [Map 6A, 46]. This owner-occupied building, completed in 1971, was a narrow (39 feet) but highly efficient slab (87%), with floors served by a side core centred on the western side.²² The building combined efficiency with flexibility and ease of floor plate subdivision. The quality and prestige given by the space of this small building were such to allow the owner-occupier to rent some of the remaining space to first class corporate tenants.²³

Collins Street squarish corner blocks

From the second part of the 1960s, the urban transformation of Collins Street that was initiated by the Colonial Mutual Life and the CRA Building, intensified and continued to erode the historical streetscape of the street. New office developments occurred,

¹⁶ "Communications House," *Constructional Review* 41, no. 4 (April 1968): 6-9.

¹⁷ "Monash House, Melbourne," *Architecture Today* 9, no. 4 (September 1967): 26-27.

¹⁸ "Structure of Buildings," *Architecture in Australia* 55, no. 5 (September 1966): 80-81.

¹⁹ "Prince's Gate," *Constructional Review* 40, no. 11 (November 1967): 10-14.

²⁰ Mahlstedt Fire Insurance, City of Melbourne Detail Fire Survey Plans, map 2, n.d. [1977?].

²¹ Mahlstedt, map 20.

²² "Efficiency is the Feature," *Architecture Today* 14, no. 3 (April 1972): 11.

²³ Part of Eagle House was rented in 1970s to a premium tenant like BHP. Melbourne Cityscope 1977, map 28, property no. 12.

often, on corner blocks. These sites, typically, had an overall area ranging from 10,000 square feet up to 20,000 square feet, and they were developed with towers of the squarish block type rather than with side core slabs. Two examples of this typology in Collins Street were the 19-storey Legal and General Assurance Building [Map 6D, 32], at the corner of Queen Street, and the 17-storey Wales Corner [Map 7C, 29], at the corner of Swanston Street. These two buildings had net floor plates of similar size, 6,600 square feet and 5,400 square feet respectively, and were some of the smaller office blocks of the “shaft-type”.

Wales Corner had a short rectangular plan of 99 feet by 68 feet. The service core and a mechanical duct, which varied in size from floor to floor, occupied the entire length of a blank wall along the western side of the plan. With the exception of a western structural bay containing the service area, the rest of the floor space was almost square in shape with a ring of column-free space that ran along three sides of the floor. The central part of the floor plate was occupied by two bays of columns and a secondary fire-isolated stair.²⁴

The floor plan of the Legal and General Assurance Building was based on a rectangular footprint of 121 by 78 feet. The plan was articulated with an L-shaped configuration imposed by a re-entrant around a laneway on the south-eastern corner. Despite the inconvenience of the south-east corner, dictated by rights of way of adjoining properties, the building had 26 feet deep space on the long sides of the floor and open space that wrapped around a rectangular service core with three lifts.²⁵ The vertical configuration of Melbourne’s squarish shaft blocks of the late 1960s followed the established practice to locate plant rooms on the top floor and in the basement, but the Legal and General Assurance Building was an exception. The main mechanical plant was located at mid-height, on the seventh floor, alongside a caretaker flat. The top floor was open and usable as an observation deck.²⁶

²⁴ State Library of Victoria, Stephenson and Turner Archives, drawings collection, Bank of New South Wales - Wales Corner Project, Drawing no. 51123, Revision A, 2 July 1964.

²⁵ “Legal and General Building,” *Constructional Review* 41, no. 6 (June 1968): 19-21.

²⁶ “Legal and General Building,” 19.

Compactness of the floor plan and all-round column free space along the street frontage was a salient attribute of squarish corner blocks. The Royal Insurance Building [Map 6A, 24], at 430-444 Collins Street, combined these spatial characteristics with rigorous modularity. Built on a site of 23,700 square feet, the 18-storey-high block had a net lettable area of 210,000 square feet spread over 15 office floors. When completed, in 1966, it was the second largest office building in Melbourne. The floor plan was 135 feet deep and 112 feet wide on Collins Street - aspect ratio of 5 to 4 - and it was subdivided into square structural bays of 27 feet. Overall, the building was controlled by a square ceiling grid and module of 4 feet 6 inches.²⁷ The structural bay of 27 feet defined column-free depth on three sides of the floor with space depth ranging up to 50 feet. The net floor plate of more than 12,000 square feet was the largest in Melbourne for 1966 and it met the net to gross efficiency target of 80%.

The quasi-square floor plan of the Royal Insurance Building, designed by Yuncken Freeman, seemed to attempt to create a four sided square free-standing building – similar but larger in footprint than the State Government Offices, which were designed contemporarily by the same architects – but the almost square general arrangement of the plan was abruptly interrupted by a party wall with the adjoining property on the eastern boundary.²⁸



Figure 4.2

Royal Insurance Building, 430-444 Collins Street, 1962-66; external and internal views

²⁷ “Head Office,” *Architecture in Australia* 56, no. 1 (February 1967): 88-89.

²⁸ “Head Office,” 89.

Larger alternatives for Collins Street

Older buildings in Collins Street were substituted by larger free-standing office blocks and towers that set back from the street line. The new buildings followed a variety of approaches, some aligning with typological patterns developed in the 1960s and others following rather atypical models of intervention.

Between 1970 and 1973, the Mutual Life and Citizens Assurance Company (MLC) developed its previous property on the south-western site of the corner of Collins Street and Elizabeth Street. The older MLC building was demolished to make room for a new 34-storey-high tower [Map 6D, 44]. In order to “maximise the economic use” of the land, the corner site for the new development was enlarged to 17,800 square feet by acquiring two adjoining properties.²⁹ The resulting parcel was quasi-square: 132 by 134 feet. The project had a north-facing plaza with a free-standing tower of quarter-circular shape. The rear of the tower was served by a circular side core with two lift banks, one serving the lowest floors, one serving the top most floors. The project was designed by the developer-builder company Civil and Civic and documented in association with architects Demaine, Russell, Trundle Armstrong and Orton, which previously designed the curved head office building for British Petroleum on St Kilda Road in 1962-65.³⁰

The tower followed uniqueness of geometric conception rather than typological convention. In the news section of *Architecture Today*, the MLC building was described to have “virtually every room on each floor [of] a different geometric shape”.³¹ The curved footprint in reality was not very efficient. The low rise floors had a gross-to-net efficiency of 73% and the high rise floors, with the benefit of the drop off of the lower group of lifts, had a modest 77% efficiency.

In 1972, the Commonwealth Banking Corporation launched the project of redevelopment of its premises at 367-373 Collins Street [Map 6D, 50]. The new headquarters were announced as the “largest-ever bank building” in Melbourne with

²⁹ Civil and Civic, *The MLC Project: a Progress Report*, March 1970, [Marketing leaflet prepared by the Head Contractor] in David Tiller, “M.L.C. project, corner Elizabeth and Collins Street, Melbourne,” thesis, undergraduate, University of Melbourne, Faculty of Architecture, Building and Planning, 1971.

³⁰ “Office Building,” *Architecture Today* 4, no. 10 (August 1962): 10; “BP House, Melbourne,” *Architecture Today* 7, no. 6 (April 1965): 15.

³¹ “Tower for M.L.C. in Melbourne,” *Architecture Today* 15, no. 4 (May 1973): 9.

initial plans for a total gross floor area of 700,000 square feet.³² The building was on a large mid-block site parcel of 37,400 square feet; it was set back 30 feet from the street boundary and it was completed with more than 400,000 square feet of net office space. The typological approach was a scaled-up version of the side core slab used at 500 Collins Street: a shortened rectangular plan (aspect ratio of 2 to 1) with the core of two lift groups partly engaged in the floor plate. Unlike 500 Collins Street though, the tower had a typical net floor area of 11,800 square feet that was completely free of internal columns – although with an unfortunate orientation facing west on the long side. Topped at 505 feet above the street level, the Commonwealth Bank House over-towered its neighbours, the Stock Exchange Building [Map 6D, 30] and the Legal and Assurance Building. When completed in 1975, it was the tallest - but not the largest - office building in Melbourne.

Column-free space was also a characteristic of the free-standing shaft of the City Mutual Centre at the south-west corner of Collins and William Streets [Map 5D, 49]. The building was 34 storeys high with a squarish footprint of 8,000 square feet of gross floor area. The typical floor was quite small for the early 1970s, and the City Mutual made up with height what could not be achieved in plan. The building reiterated, and anticipated for the first time in Collins Street, the configuration of the building type that emerged a few years earlier in other parts of the Central Business District: a free-standing tower with a central core, in this case almost exactly square with 112 by 95 feet plan, and with column-free space on four sides.³³

4.2 Corner of Bourke and William

The American cluster

An American Melbournian³⁴

In 1963, the Australian Mutual Provident Society acquired for £6,000,000 the properties at the south-western corner of the intersection of Bourke and William Streets. The insurance company had outgrown in staff size the capacity of the old AMP premises at 425 Collins Street and at 60 Market Street, and decided to build a new central

³² “Largest-ever Bank Building,” *Architecture Today* 14, no. 1 (February 1972): 5.

³³ Mahlstedt, map no. 21.

³⁴ The tower of AMP Square was pictured in the front cover of the journal of the RAIA Victorian Chapter under the title “AMP SOM BSM: an American Melbournian,” *Architect* 3, no. 8 (May-June 1970).

headquarters. The land purchased was part of a five-acre grant given by the British Government to the Church of England, and it had been earlier occupied by the St James School, demolished in 1905. The property was merged by AMP with an adjoining parcel, and the result was a square island block in the western part of the CBD of approximately 83,200 square feet.³⁵

The block was bounded by William, Bourke, Church and Little Collins Streets and it was in a prominent position for the city since it was slightly elevated from the rest of nearby properties at the intersection of William and Collins Streets. The land was also higher than the sites of the recently built hub of insurance companies at the intersection of Bourke and Queen Streets. The north east corner of the site was the highest point of the land, and thus it lent itself for a tall building that could signal the prestige of the Society. AMP approached the project with the will to create an unprecedented operation of real estate, commercial construction and civic design in the city. The brief required accommodation under one roof for AMP's staff, office space for rental, retail and civic open space.

Considerable know-how on tall building existed locally, not secondarily with Bates Smart & McCutcheon (BSM), with whom the insurance company had historical acquaintance since the 1920s,³⁶ and who had demonstrated competence and skill with numerous tall office building projects built in the city between 1955 and 1965. But the complexity and the size of the Bourke Street project were such that AMP felt necessary to refer to the services of a leading American architect. An architectural firm with experience in economic assessment and urban design of high-rise projects was required,³⁷ and the San Francisco office of Skidmore Owings and Merrill, which in Melbourne had already designed for MLC the Shell Corner, was selected for the job.

SOM undertook the design and feasibility study between 1963 and 1964.³⁸ The initial concept contemplated several alternatives, some of which explored schemes adhering to

³⁵ "About the site," *The Age*, [AMP Square Supplement], November 17, 1969, 21.

³⁶ BSM designed the head office of AMP at 425 Collins Street in the late 1920s. "The New A.M.P. Building," *Journal of the Royal Victorian Institute of Architects* 29, no. 1 (March 1931): 82-97.

³⁷ Rico Bonaldi, interview, 1 September 2014.

³⁸ "A.M.P. Square, Melbourne," *Architecture Today* 12, no. 2-3 (December 1969 – January 1970): 16-17.

the prescriptive limitations imposed by the UBR.³⁹ SOM called into question these restrictions and concluded that the building regulations, on a large site like the one in question, had the effect to limit severely economic design solutions with “either equal towers or low buildings of tremendous floor area or a combination of both; that is a broad, deep base with relatively thick towers”.⁴⁰

AMP’s monolith [Map 5B, 37]

The scheme selected for further development had “worked itself out” as a monolithic tower with “quasi-historical” monumentality, minimum footprint required and maximum space quality.⁴¹ In 1965, SOM continued to work until the schematic design was completed;⁴² from 1966, SOM – at the time heavily occupied with major commercial projects in the United States - passed the project into the hands of BSM, who became local architects responsible for the executive part of the project.⁴³

At AMP Square the request to build higher than imposed by regulation was traded for civic concessions of public open space, car parking, one auditorium at basement level and retail accommodation at ground floor. The tower was complemented by an L-shaped six-storey block that bordered the south and western boundaries. This block, known as the St James Building, was occupied by retail tenancies at the ground floor and professional suites on the upper floors. Since the tower occupied the most prominent angle on the north-east side of the land, the St James Building was designed with 45 degrees-sloped external walls, in an attempt to maximise access to north-eastern natural light.⁴⁴

³⁹ Daryl Le Grew, “Central business district redevelopment: development and design criteria for large scale commercial and business centres,” thesis, undergraduate, University of Melbourne, Faculty of Architecture, Building and Planning, 1972.

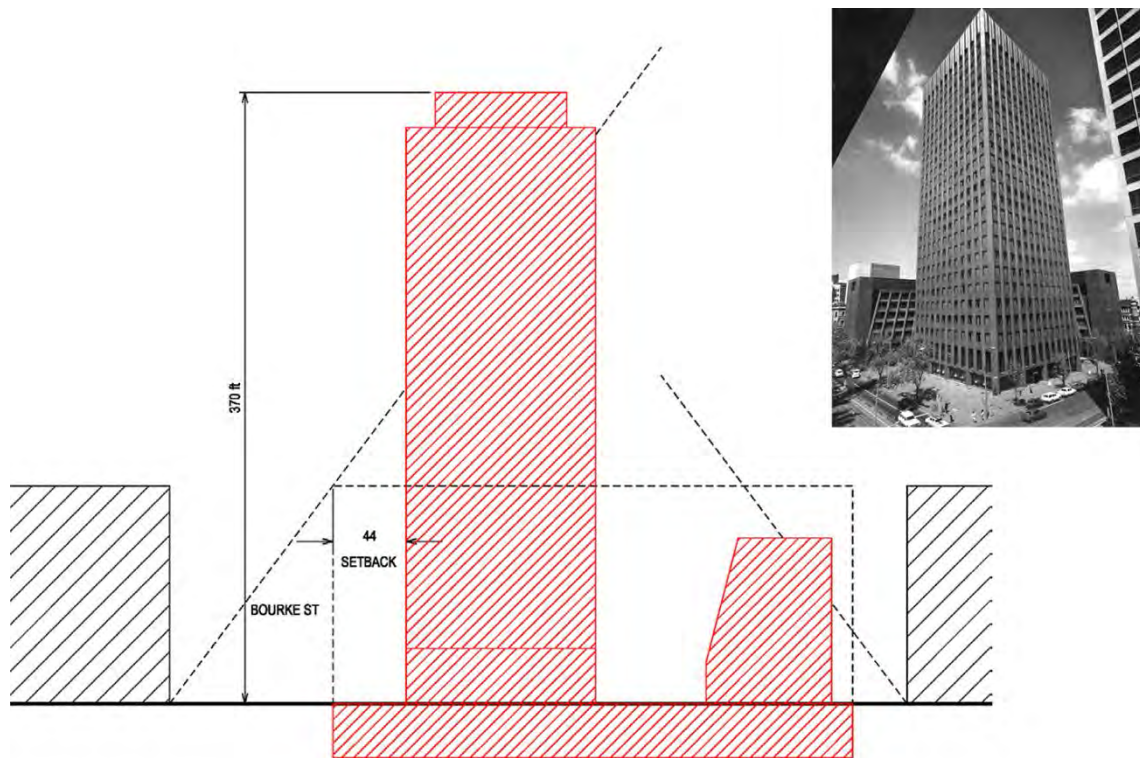
⁴⁰ Skidmore Owings Merrill, *AMP Square Feasibility Study*, cited in Le Grew, “Central business district redevelopment,” B/6.

⁴¹ Richard Foster, interview, 11 December 2013.

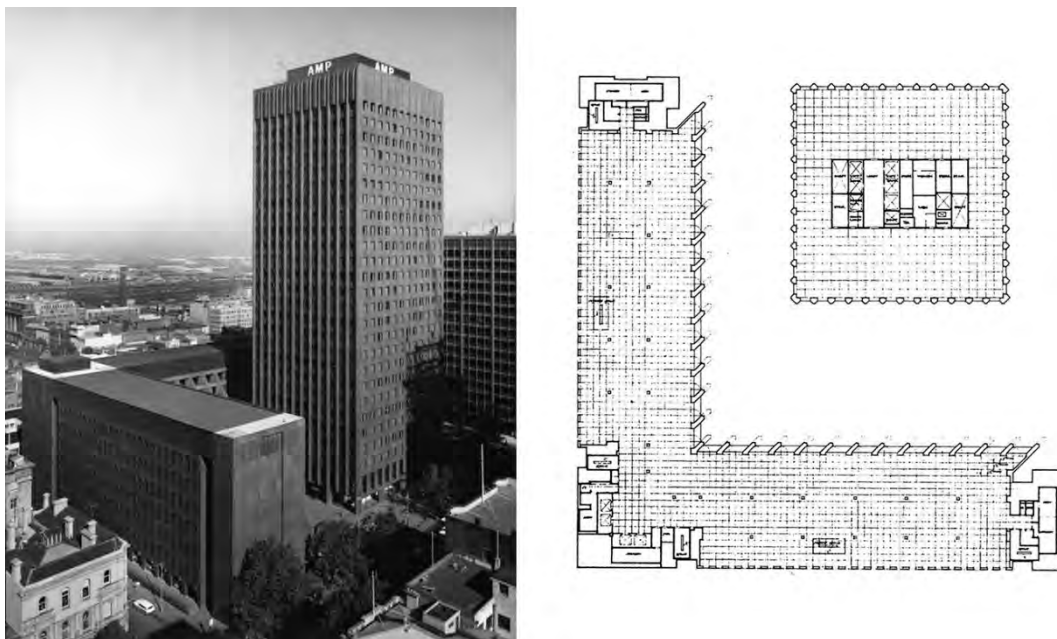
⁴² “A huge job in quick time,” *The Age* [AMP Square supplement], November 17, 1969, 20.

⁴³ Richard Foster, interview, 11 December 2013.

⁴⁴ Foster, interview.

**Figure 4.3**

AMP Square, 527-555 Bourke Street, 1965-69, site section and building height diagram

**Figure 4.4**

AMP Square, aerial view and plan of tower and St James Building, 1969

AMP required a net floor plate area between 10,000 and 12,000 square feet and room for future growth. During the feasibility study, the overall net floor area allocated for occupation by AMP was in the order of 150,000 square feet.⁴⁵ The final scheme, including the St James premises, had 835,000 square feet gross floor area and - inclusive of retail and office space in the St James Building - 559,000 square feet net lettable area. It was a project twice as large as any precedent office development of the city, such as, for example, the National Mutual Life Centre, or the twin slabs of the Gas and Fuel Corporation in Flinders Street. The tower had a total net lettable area of approximately 276,000 square feet of which AMP, in the early 1970s, regularly occupied between 45% and 36% of the space. The rest of the space was rented; Alcoa, the international giant of the aluminium industry, occupied about 8% of the floor space for many years after completion.⁴⁶

The plan of the tower was a square of approximately 126 by 126 feet. It was planned on a square module of 5 feet subdivided into submodules of 2 feet 6 inches and of 1 foot 6 inches, which governed the ceiling grid.⁴⁷ The office space was column-free, 42 feet deep along north and south. The lift core (80 feet by 40 feet wide) was impeccably coordinated within the modular plan. The arrangement of lift banks, toilets and mechanical ducts allowed circulation, egress and ease of subdivision into multiple tenancies.⁴⁸

For the first time in Melbourne, vertical circulation was separated into two groups of lifts: the low rise, which served up to level 14, and the high rise, which served from level 15 to level 24. The 80% efficient floor plate had 12,600 square feet of net floor area, and it was the largest and most sought after first-class office space in the city. In the AMP tower, city office space rentals, for the first time, reached \$6 per square foot. These top rentals were part of a marketing strategy of differentiation, which included lower quality space in the nearby wings of the St James Building.⁴⁹

⁴⁵ Skidmore Owings Merrill, *A.M.P. Square, Melbourne – Feasibility Study*.

⁴⁶ PROV, City of Melbourne, VPRS 5708, Council Rates 1970-1974, Lonsdale Ward.

⁴⁷ "A.M.P. Square Ceiling," *Architecture Today* 12, no. 2-3 (December 1969 -January 1970): 19.

⁴⁸ Rico Bonaldi, interview, 1 September 2014.

⁴⁹ Richard Ellis Sallmann & Seward, "Feasibility Study and Market Analysis," 24.

In late 1969, after six years of development, the 372 feet tall AMP Square was Melbourne's tallest and most prestigious building. The project brought into the city, alongside new methods of economic forecast and design testing imported directly from the United States of America, a new model of development that set a new pace for building size, owner-occupied prestige, civic design and space quality.⁵⁰

AMP land, BHP house [Map 6A, 45]

AMP Tower signified the solid wealth of its patron, the first insurance company in Australia and the national leader of real estate investment that, since the mid-1950s, had strategically and successfully shifted interests in commercial property development. In Melbourne, AMP had sponsored before a number of speculative commercial office projects including, for example, 406 Lonsdale Street, and the office building at 350 Collins Street, rented to the Australian Taxation Office [Map 6B, 38]. By the late 1960s, the activity of the company in property investment was one the most profitable components of its considerable revenue which, according to *The Age*, could rival in magnitude the Australian Federal Budget.⁵¹

In 1969, on the trail of this profitable track-record, AMP acquired the block of land opposite AMP Square, at the south-eastern corner of the intersection of Bourke and William Streets. The site, occupied at 535 Bourke Street by the historic Menzies Hotel, was consolidated by AMP with another two parcels of land, one adjoining along the southern boundary, the other adjoining on the eastern boundary and for the full depth of the block from Bourke Street through to Little Collins Street. The resulting plot was an L-shape site of approximately 41,500 square feet.⁵² Due to the prominent location, the site lent itself to commercial development that could match, and possibly even surpass, AMP Square as its prestigious counterpart. The site was thus developed to build a new multistorey office building.

The project went ahead as BHP House, on the basis of a complex long-term rental agreement that AMP established with Broken Hill Proprietary (BHP) as the future

⁵⁰ "Australian Mutual Provident Society. A giant in the skyline," *The Age*, November 17, 1969, 10-19.

⁵¹ "Figures rival the Budget," *The Age* [AMP Square supplement], November 17, 1969, 19.

⁵² State of Victoria, Department of Environment, Land, Water and Planning, Certificate of Title V10477 F249 and Parent Title V09125 F053 (accessed 2 December 2013).

tenant of the building. The agreement gave BHP exclusive management and letting rights on a new building to be erected on AMP's land; in return, AMP received a guarantee for a minimum annual return of 7.75% on the investment.⁵³ In the context of this agreement, BHP exercised complete control over the design of the building.

After consideration was given to engage the same design team of AMP Square, BHP determined to erect a building that would stand out as a different proposal from AMP Square and opted to engage a different team of architects.⁵⁴ The Melbourne-based firm of Yuncken Freeman was commissioned for the architectural design of the building. BHP made the specific request to use its building products throughout and to erect a building that could promote steel as a building material and natural gas as an energy source.⁵⁵ To respond to the technological challenges set by BHP, Yuncken Freeman established collaboration with the Chicago office of Skidmore Owings Merrill, who were engaged as structural consultants.

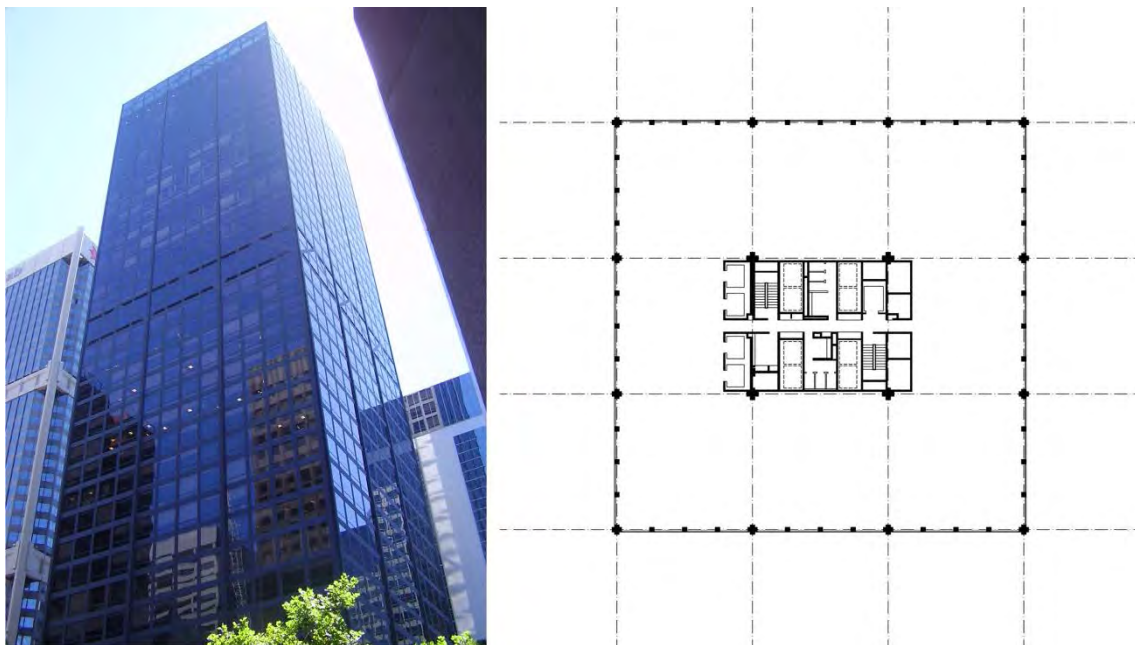


Figure 4.5

BHP House, 130-148 William Street, 1970-1972; external view and medium rise floor plan

⁵³ Melbourne Cityscope, map 27, property 17.

⁵⁴ Rico Bonaldi, interview, 1 September 2014.

⁵⁵ "Melbourne's Tallest," *Architecture Today* 11, no. 7 (May 1969): 6

After its inception in 1969, BHP House was developed in close collaboration between Yuncken Freeman and SOM Chicago and it was completed in 1972.⁵⁶ The tower was 500 feet tall, free-standing and complemented by a seven-storey car park annexe built at back of house, on the southern part of the L-shaped parcel. With a footprint of 126 feet by 126 feet the project was “almost identical” in plan to AMP Square.⁵⁷ BHP House, however, differed from AMP in its vertical circulation system and in its innovative overall structural concept. The tower was the first in the city to be designed with three groups of lifts: low rise, medium rise and high rise. The position of the 16 passenger lifts was arranged with two banks of 4 lifts for low rise and medium rise, which were mirrored on the external sides of the core. The high rise floors were served by a central group of 8 lifts split in two banks of four. The speed of the lifts increased with height, 500 feet per minute for the low rise, 700 for the medium rise and 1,000 for the high rise, which kept maximum waiting time below 20 seconds. The vertical circulation system was further defined with transfer floors at level 14 and level 22.⁵⁸



Figure 4.6

BHP House; internal views, typical upper floor and executive room, 1972

The vertical articulation of the core made the low rise floor 79% efficient for net to gross area and, at the same time, it allowed cross-circulation with a secondary corridor. From the medium rise upwards, the efficiency rose to 85%. In essence, BHP House had

⁵⁶ Philip Goad, “BHP House,” in Jennifer Taylor [ed.], *Tall Buildings: Australian Business Going Up: 1945-1970* (Sydney: Craftsman House, 2001), 260-281.

⁵⁷ *Cross Section*, no. 201 (July 1969).

⁵⁸ “New Concept in Building Construction: B.H.P.’s New National Headquarters,” *Contracting and Construction Equipment* 23, no. 5 (May 1969): 14.

three groups of lifts in a very similar footprint of AMP Square - which instead had only two groups of lifts – but had even more flexible predisposition for subdivision into multiple tenancies. Furthermore, with a building module of 10 feet, BHP House had a more rarefied structural grid than any of its local predecessors: main columns span 41 feet apart, as much as the main leasing depth from façade to core, providing the widest unobstructed panoramic views of the city.

Capital Tower [Map 2C, 58]

In 1972, after the completion of BHP House, three of the four corners of the intersection at Bourke and William Streets were occupied by tall office buildings. These three buildings were designed, or at least strongly influenced in concept, by the American firm of Skidmore Owings Merrill. The fourth high-rise cornerstone of the intersection was eventually developed on the plot adjoining the north-eastern corner of the intersection, which was occupied by the historic warehouse building of Goldsbrough Mort, completed in 1862. Plans by the British Hammerson Group to develop the remaining corner site with the demolition of the old Goldsbrough Mort Building, had existed since 1969, but they did not eventuate.⁵⁹

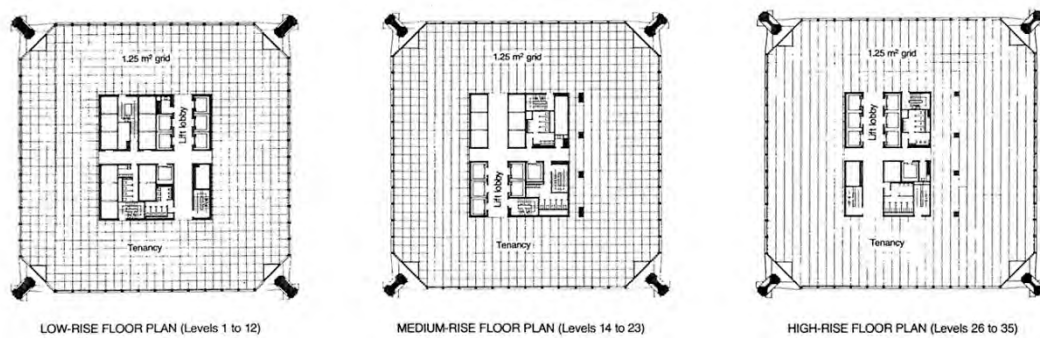
The land at 495-512 Bourke was bought by British property investment company Abbey Capital in 1970 for \$6,500,000. The site of the development was an aggregated parcel of 46,700 square feet that ran north-south from Bourke Street through to Little Bourke Street, and was bounded by the lane of Little William Street to the west. In 1974, Abbey Capital lodged application to the City of Melbourne for the development of a multi-storey project known as Capital Tower. The design of the building was commissioned to local architects Godfrey and Spowers. During the development, Abbey sold the property, inclusive of the building under construction, for a total value of \$48,750,000 to the future anchor tenant of the project, the National Bank of Australia (NBA). At the time of the transaction, the cost of the building, with the structure at full height, was valued at \$38,300,000. The project was sold in the context of a long-term plan of the British real estate group to liquidate most of its properties in Australia.⁶⁰

⁵⁹ “The Top Corner,” *Architect* 3, no. 2 (May-June 1969): 12.

⁶⁰ Cityscope, map 20, property 21.

**Figure 4.7**

Capital Tower / NBA, 498-502 Bourke Street, 1973-78

**Figure 4.8**

Capital Tower / NBA House, typical plans, 1978

From the inception of the project, Godfrey and Spowers were instructed to design an office building with minimum intrusion of vertical structure at the typical floors and at

the ground floor alike.⁶¹ Additionally, due to Abbey Capital's intention to sell the property in the short term, there was the need to minimise construction time.⁶² The local architects worked in close collaboration with the client and with London-based structural engineering firm Ove Arup and Partners. Structural and planning flexibility were met with a further evolution of the square plan tower, where the concept of rarefied vertical structure introduced at BHP House was taken to the extreme. Vertical supports were concentrated on four external corner columns tied by four transfer-beams that created a ring in correspondence of plant room levels. Behind the columns, a triangular penetration on the floor allowed vertical distribution of mechanical services through a triangular shaft.⁶³

The result was a floor plate with perimeter space on four sides that was completely free of columns both in depth and along the elevations. Furthermore, the chamfers created by the external corner columns, introduced a tenant-appealing plan with the potential to fit up to eight corner offices on each floor.⁶⁴

After becoming property and headquarters of the National Bank of Australia, Capital Tower was eventually renamed NBA House. Once completed in the late 1970s, NBA House was the fourth cornerstone of the cluster of skyscrapers at the corner of Bourke and William Streets. After the first prototypical developments of Hume House and Shell Corner, the cluster at the intersection was completed from the mid-1960s by ACI House, AMP Square, BHP House and, later on, NBA House. These last three buildings, in particular, were representative of the city's tall building commercial trends from the second half of the 1960s to the 1970s, and all-three adhered to the formal 'consensus' of the square plan tower that Harry Wexler, the representative of Australian quantity surveyors, described at the 1971 BOMA conference. Moreover, these buildings reflected a new praxis of urban design assessment by planning authorities, which was based on zoning and built-form controls far more elaborate than those that affected the previous generation of city tall buildings.

⁶¹ "National Bank House," *Constructional Review* 51, no. 4 (November 1978): 55.

⁶² John Davidson, interview, 28 November 2014.

⁶³ Davidson, interview.

⁶⁴ Davidson, interview.



Figure 4.9

Corner of Bourke and William Streets, Melbourne, aerial view, 1978 circa

4.3 The tall city bonus

Open space, building and skyline controls

The problem of congestion

In 1964, the City of Melbourne publicised the Central Area Planning Scheme, the first comprehensive set of planning provisions of the city aimed to regulate urban design in the central area. In its general lines, it was an attempt to resolve increasing problems of increasing vehicular and pedestrian congestion. The scheme also had the scope to implement with urban design controls the zoning provisions set a decade earlier in the

1954 Melbourne Metropolitan Planning Scheme.⁶⁵ Although the 1964 Scheme was never adopted formally, it was administered *de facto* by the City of Melbourne with an Interim Development Order (IDO) from 1965 onwards.⁶⁶



Figure 4.10

Melbourne, Central Business Area; pedestrian and traffic congestion at peak hour, 1964 circa

The solutions to alleviate congestion proposed by the Central Area Planning Scheme were conceived to fit with pre-existing trends of commercial office development initiated in the late 1950s. The Scheme envisaged that the existing patterns of business development should continue “with greater convenience and efficiency”,⁶⁷ whilst the character of the central City was to be “maintained and its dignity and attractiveness enhanced”.⁶⁸ With congestion considered as the chief problem to be resolved, the

⁶⁵ PROV, City of Melbourne, VPRS 8945/P2, unit 196, Building and Town Planning Committee, memorandum of the Town Planner, subject: Central Area Planning Scheme 1964, 27 September 1965.

⁶⁶ Vicki Michele Davies, “Commercial accumulation and planning controls: a case study in the City of Melbourne,” thesis, undergraduate, University of Melbourne, Faculty of Architecture, Building and Planning 1978, 39.

⁶⁷ E. F. Borrie, *Report on a Planning Scheme for the Central Business Area of the City Melbourne*, (Melbourne: City of Melbourne 1964), 22.

⁶⁸ Borrie, 22.

provision of open space alongside commercial office development was strongly encouraged.

Open space, considered an important feature of the most notable historical European cities, was thought to be lacking in the cities of the “newer” continents like North America and Australia, where its benefits, according to the town planners of the City of Melbourne, had often been “largely overlooked”.⁶⁹ The need for open areas was promoted in the Scheme by indicating specific sites where alleviation from congestion should be dealt as a priority. The concept of a large central public open space, for example, was mentioned as highly desirable. Since 1967, this issue was discussed and considered at length by the City of Melbourne, particularly in relation to the development of the city block bounded by Swanston Street, La Trobe Street, Elizabeth Street and Lonsdale Street (the area later known as Victoria Central and then later as Melbourne Central).⁷⁰

Prior to the introduction of the 1964 Scheme, *ad hoc* contributions for public open space in the inner city had already been negotiated by the City of Melbourne with privately financed tall office developments. Open space in the form of forecourts, plazas and setbacks was already a reality in Collins Street in the mid-1960s as testified by the CRA Building, the Colonial Mutual Building, the National Mutual Life Building and the Royal Insurance Building.

Considering these antecedents, the City of Melbourne gave explicit indication to provide open space for the sites surrounding the intersection of Bourke and William Street. The upcoming development of AMP Square, for example, was openly encouraged by the City of Melbourne as an opportunity to introduce forecourts and resting areas:

It is to be hoped that when the Australian Mutual Provident Society develops its newly acquired site at the corner of William and Bourke Streets, an attractive open treatment will result. This question has already been taken up with the Society.⁷¹

⁶⁹ Borrie, 37.

⁷⁰ PROV, City of Melbourne, VPRS 8645/P2, unit 197, Building and Town Planning Committee, meeting minute 67/1038/67 [1967].

⁷¹ Borrie, *Report on a Planning Scheme for the Central Business Area of the City Melbourne*, 39.

Since 1964, the creation of a large open space area was desired also for the site opposite the Law Courts in Little Bourke Street, an area of the city where, at that time, “many people have frequently to wait (...) and there is nowhere pleasant where they can do so”.⁷² In the 1970s, open space was eventually allocated at the northern end of the site developed for Capital Tower/NBA House in Bourke Street. Recommendations for secondary public open spaces were distributed also in other more peripheral parts of the central business area, for example, in proximity of the Spencer Street railway station, on the site owned and to be developed by the Melbourne Metropolitan Board of Works for its headquarters [Map 5A, 47].

Plot ratio

Part III of the Central Area Planning Scheme introduced a number of planning controls that related to density and built form. Clause 19 of the Scheme introduced the pivotal control of “plot ratio” in Melbourne CBD.⁷³ This type of control, also known in other cities as floor space index or floor area ratio, was assigned according to different zones of the city as a multiplying factor that set the density of a development in proportion to the area of the site. In Melbourne, the term plot ratio was defined precisely as “the ratio of the floor area of a building to the area of the land within which the building is or is to be erected”.⁷⁴ So, for example, in a site of 5,000 square feet area, the apportionment of a plot ratio of 10 meant that a building could be erected with maximum 50,000 square feet of floor space. For the purposes of plot ratio calculations, the “floor area” was defined as:

(...) the sum of the area of all floors of a building (...) including the floor of any basement, mezzanine or attic, and the horizontal section of all walls at floor level including the portion of any party wall comprised in the building, but excluding any part of such building used for housing mechanical equipment provided for the better enjoyment of the building or set aside as a loading dock or provided for the parking of vehicles.⁷⁵

In simplified terms, when applied to a commercial office building, each site possessed, according to the assigned plot ratio, an implicit allowance of maximum floor space

⁷² Borrie, 41.

⁷³ City of Melbourne, *Central Area Planning Scheme 1964, Planning Scheme Ordinance* (Melbourne: City of Melbourne, 1964): 20.

⁷⁴ City of Melbourne, 7.

⁷⁵ City of Melbourne, 5.

based on the gross floor area of the building with the exclusion of mechanical plant rooms and car parks.

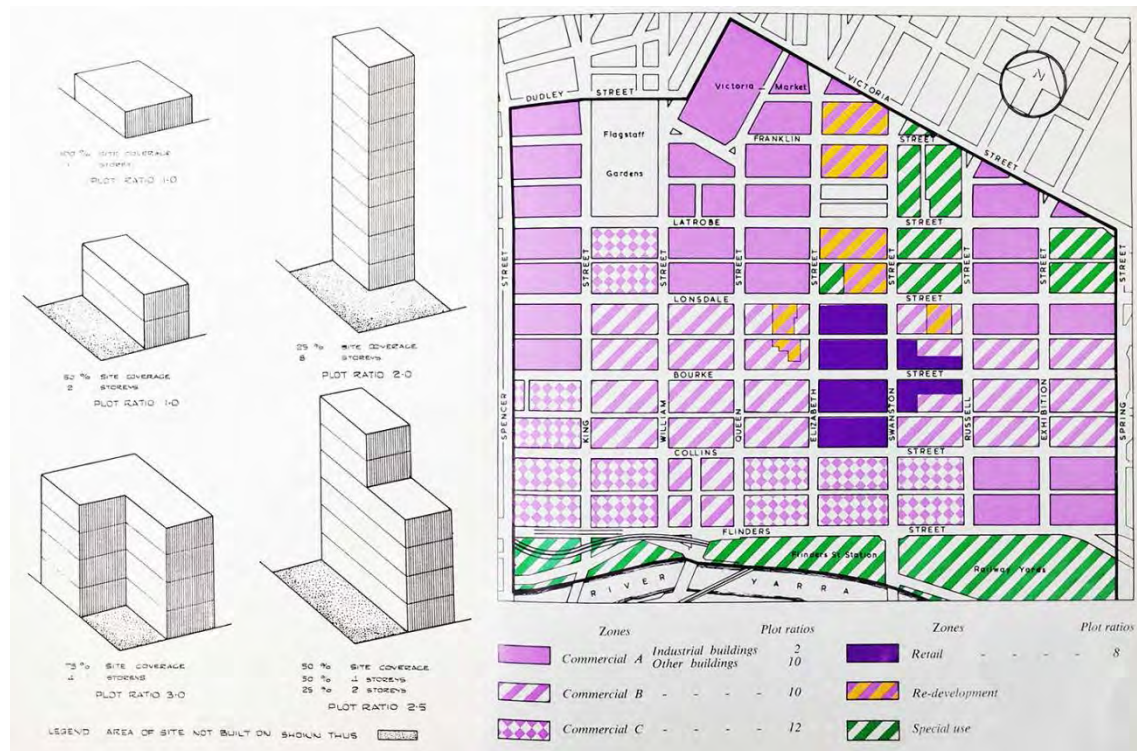


Figure 4.11

City of Melbourne, Plot Ratio Explanatory Diagrams (left) and Zoning Map (right), 1963-64

Plot ratios in the inner city were allocated according to a map of functional zones. For commercial office buildings, plot ratios were distributed in three zones, defined as Commercial A, B and C, which had, respectively, basic plot ratios of 10 for the first two and 12 for the third. With Clause 20, the Scheme introduced a mechanism of bonus that allowed, under specific circumstances, to increase the basic plot ratio assigned to the zone.⁷⁶ The bonus was determined by multiplying the basic plot ratio by a factor determined by the formula:

$$\text{Plot Ratio Bonus} = (a / A) \times N$$

where “A” indicated the area of the site, and “a” indicated the area of a set back arcade or footpath provided in the project. The numerical factor “N” was a constant set by the

⁷⁶ City of Melbourne, 21.

conditions that triggered the justification for a bonus and that varied according to a set of urban design initiatives, which included the provision of public space, like arcades, setbacks and enlarged footpaths.

Low centre, high ends

In a commentary attached to the Planning Scheme and prepared by Edwin Borrie,⁷⁷ the town planning consultant and former City Engineer of the City of Melbourne, the strategy for the introduction of plot ratio controls in Melbourne was justified in three points:

- a) to limit the growth of industrial developments in the inner city;
- b) to reduce congestion in the central retail part of the city;
- c) to encourage commercial developments on the external parts of the city grid with higher plot ratios.

In order to limit congestion in the central retail zone of the city, guidance was given to develop commercially only on the external parts of the grid, imprinting a specific physical aspect of the skyline. Accommodating private commercial interests to erect office buildings along pre-existing axes of development (Collins and Bourke Streets in the east-west direction and William, Queen and Exhibition Street in the north-south), the Scheme concentrated commercial office buildings within two distinct and relatively dense clusters of towers. These two external poles of commercial development were located in the most topographically favourable parts of the city, at the top of two hills, and they contrasted with a central lower “dish” of retail strips in Swanston and Elizabeth Streets, where older and lower buildings, besides some exceptions like the Colonial Mutual Life Building, were prevalent.⁷⁸

The first cluster began to coagulate at the eastern end of Collins Street, the “Paris End”, where, in the mid-1960s, the CRA Building towered above anything else on that part of the city. By the early 1970s, after the completion of AMP Square and BHP House, the

⁷⁷ PROV, City of Melbourne, 8945/P2, unit 197, Building and Town Planning Committee, Edwin F. Borrie, Melbourne City Council Central Area Planning Scheme 1964: Summary and Comment by the Town Planning Consultant, 20 September 1965.

⁷⁸ Yvonne von Hartel, interview, 19 November 2013.

western cluster was the high-point of the skyline. By the late 1970s, with the progressive completion of Collins Place and Nauru House, the eastern end of Collins became an equally strong counterpoint, laying out precedents and conditions for further and more intensive developments that eventuated along the street in the 1980s and early 1990s.



Figure 4.12

Model of Melbourne CBD with Collins Place Proposal, 1971

The perimeter and diagonal rule

The regulatory changes brought by the 1964 Planning Scheme were paralleled by some amendments of the fire-safety prescriptions of the Uniform Building Regulations for means of egress.⁷⁹

In the late 1960s, provisions for fire-isolated stairways were changed by increasing the fire resistance requirements of “Type 1” construction from two hours to three hours. Another amendment affected the minimum distance requirements between multiple means of egress. Since the first publication of the UBR in 1945, the location of exits from buildings was regulated by Clause 2705, which indicated the maximum distance permissible from any point of a floor to a fire-isolated exit. For buildings without a “high-hazard” type of occupancy - such as were considered office buildings - the

⁷⁹ Uniform Building Regulations, Victoria, 1945, chapter 27, “Means of Egress,” 93-99.

maximum permissible distance to an exit was 100 feet for floors without sprinklers, and 150 feet for floors protected by sprinklers.⁸⁰ The number of exits depended on estimates of occupancy in relation to the destination of use. In the case of multiple exit requirements, exits were required to be “as far apart as practicable” and “distributed as uniformly as possible”.⁸¹

From 1969, this part of the regulations changed with the introduction of specific criteria of minimum distance between multiple exits:

Where two or more exits are required to serve a storey basement space or room, two of the exits shall be located not closer than one fifth of the perimeter or three-quarters of the diagonal of such storey basement space or room, whichever is the greater, measured within the walls.⁸²

The new requirement had repercussions for multi-storey office buildings. Given the trend for larger floor plates, and assuming the occupancy rate of one person every 100 square feet, tall office buildings in Melbourne required generally a minimum of two exits per floor. This provision had particular relevance for the prevailing use of centre core layouts, as used, for example, in Shell Corner, AMP Square and BHP House, where two fire-isolated stairs were located in the central service core.

The new prescription gave a measurable parameter of safety in lieu of what until then was a vague recommendation to keep fire stairs ‘as far apart as possible’. For example, in a square tower of 100 feet sides exits could be set apart as close as 80 feet, which was equal to one fifth of the perimeter of 400 feet. In a rectangular tower with side core of similar area, say with a floor plate 200 feet by 50 feet wide, the minimum distance required between two exits could be 155 feet, which was equal to three quarters of the diagonal of 206 feet (Figure 4.13). In summary, the new exit distance prescriptions consolidated the *ad hoc* practice developed with Melbourne’s seminal tall office buildings of the 1960s and 1960s (ICIANZ House, ACI House, and State Government Offices). The new provisions confirmed the principle with which square plan centre core towers were allowed to concentrate fire exits at a closer distance. Conversely, after

⁸⁰ UBR 1945, 2705 (a), “Location of Exits,” 94.

⁸¹ UBR 1945, 2705 (d).

⁸² UBR 1969, 2705 (e), 160.

1969, elongated rectangular slabs were explicitly compelled to include an additional fire-rated stairwell within the open floor plan.

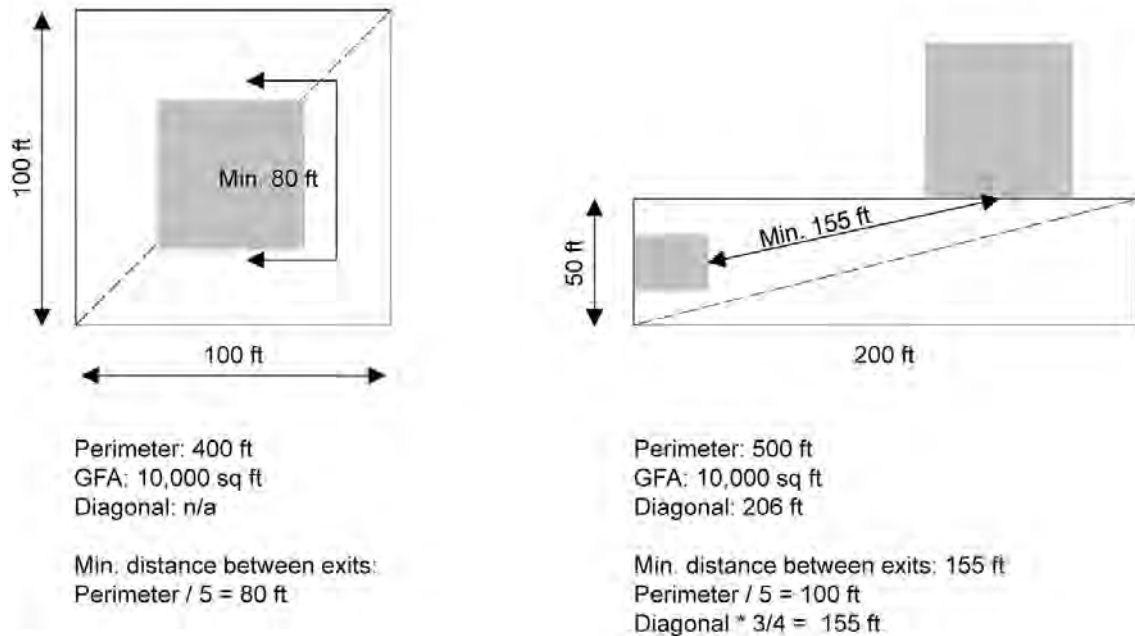


Figure 4.13

Diagrams of minimum distance requirements for means of egress according to UBRs, 1969

The BHP bonus

At the Building and Town Planning Committee of the City of Melbourne, the routine to assess applications for *ad hoc* modifications of the UBR, which started in the late 1950s, continued with increased frequency through the 1960s, and following the years immediately following the 1964 Scheme. The amendments proposed covered, in particular, clauses related to building height (clause 901, 903); in many cases they extended to other aspects of the regulations, including fire safety.⁸³ The introduction of plot ratio control had the benefit to stop, at least in principle, any discretionary uncertainty regarding the amendment of the UBR on an *ad hoc* basis for building height matters. Plot ratio controls, however, were not immune from pressures of modification,

⁸³ PROV, City of Melbourne, VPRS 8945/P2, units 194-198. Numerous office building project applications and related motivations of the requests are recorded in the meeting minutes of the Building and Town Planning Committee especially in the period 1964-1970.

although these objections did not question principles but rather some details of quantitative character.

Soon after the publication of the 1964 Planning Scheme, three objections were lodged against the methods of justification for plot ratio bonuses.⁸⁴ The first objection was lodged by the Australian Mutual Provident Society and stated that “the increments allowed to plot ratio for set-backs, arcades and passageways [were] subject to inconsistencies and could in some cases be inadequate.” A second objection was raised by the Australian Planning Institute, on grounds that “there could be a doubt or ambiguity in the case of an irregular set-back”. A third objection was submitted by the Victorian Insurance Company requesting that the same clause “should be more clearly defined”. All these objections were considered by the Town Planning Committee and Clause 20 of the Scheme was subsequently amended accordingly.⁸⁵

Another trigger of modification to the same clause came directly from the specific circumstances of one project, BHP House. In 1967, Yuncken Freeman lodged an application to amend clause 901 of the UBR in order to construct BHP House to a height of 500 feet.⁸⁶ The application received no objection from the Committee. It had become ordinary praxis, by then, to accept modifications to building height restrictions in the context of the new planning controls based on plot ratio.

In 1968, Yuncken Freeman lodged another proposal of amendment to the Building and Town Planning Committee requesting “a re-assessment of the permissible basic plot ratios” by changing the zoning of the site from Commercial B (plot ratio 10) to the zone of Commercial C (plot ratio 12). The request was not accepted by the Committee on the basis that the site was “centrally situated between public transport facilities, and therefore there was no justification for increasing the plot ratio to 12 as was permissible for buildings adjacent to public transport facilities”.⁸⁷

After rejecting the change of zoning, the Committee considered nonetheless to modify the list of justifications that allowed a bonus to the plot ratio. The frontage of BHP

⁸⁴ PROV, unit 196, Building and Town Planning Committee, memorandum, 16 February 1966.

⁸⁵ PROV, “Schedule R – Objections to Clause 20 of the Ordinance”.

⁸⁶ PROV, VPRS/P2, unit 198, Building and Town Planning Committee, minute 67/5526/173, 68.

⁸⁷ PROV, minute 68/1920/298, 147.

House was designed with a setback of 40 feet from William Street and a setback of 5 feet from Bourke Street. This siting of the tower was justified by the architects on grounds of the superior “civic design” to align the building with the tower of AMP Square. The marginal setback on Bourke Street, however, allowed only limited access to the provisions of the mechanism of bonus.

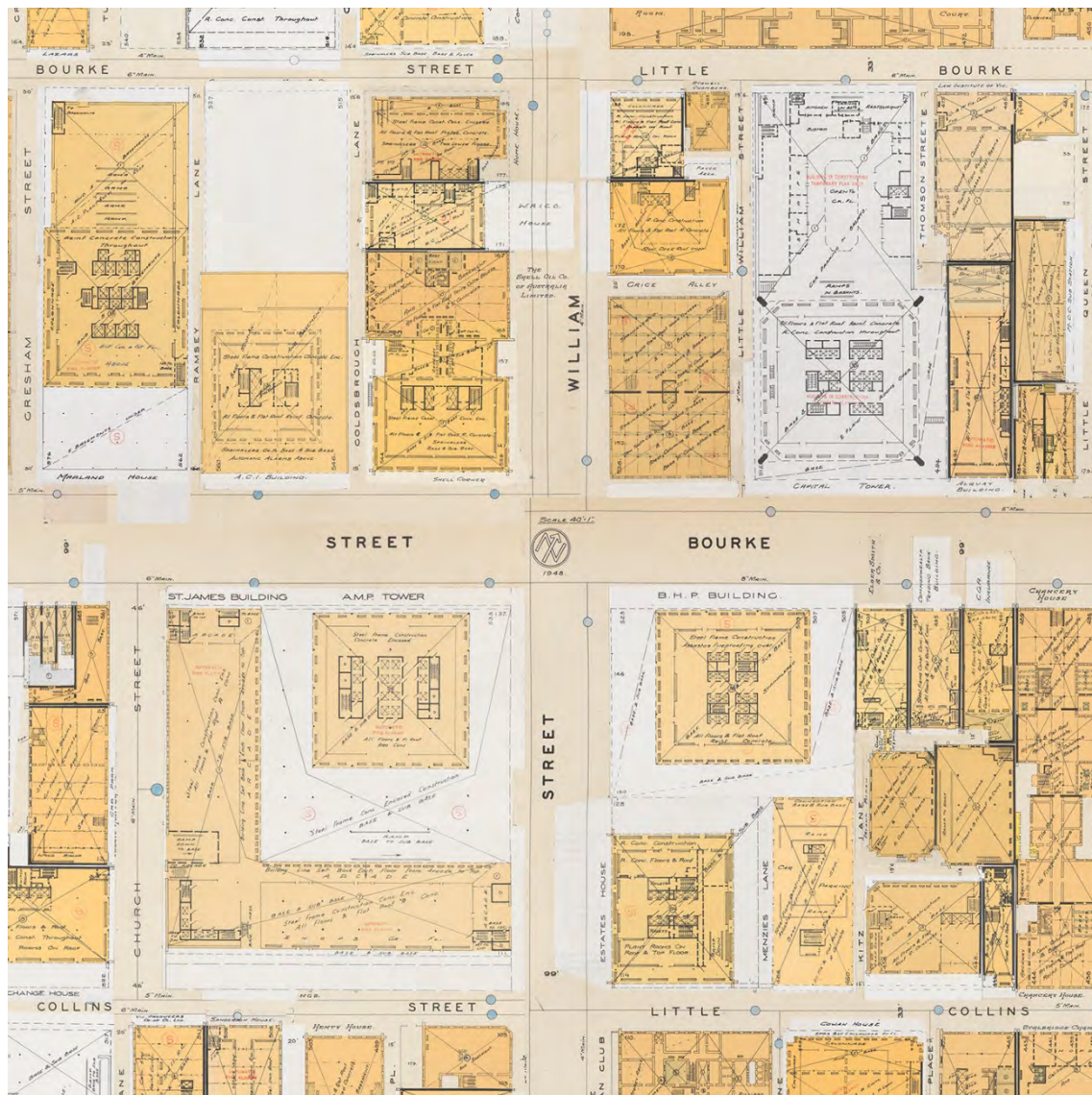


Figure 4.14

Site plan of buildings at corner of Bourke and William Streets, Melbourne, 1977 circa

The ground floor lobby was set back from the tower line, creating a colonnade. Moreover, this provision of open space under cover was reinforced by ample open public space at the internal sides of the boundary, which resulted from the location of

the tower on the north-west corner. Considering these aspects in face of the architect's request, the committee found to be "not unreasonable for a bonus to be given when the face of a building [in this case also due to a setback lobby at ground floor] was set back from the two internal sides of a corner block". Furthermore, the decision to allow a bonus according to this logic of interpretation prompted the Committee to proceed with an amendment of Clause 20. As a result, the list of circumstances allowed for a plot ratio bonuses changed, and the new provision, initiated by AMP, became available for the city at large.



Figure 4.15

BHP House; street views public open spaces along Bourke Street (left) and William Street (right)

New circumstances

In May 1968, stemming from the *ad hoc* circumstances allowed for BHP House, a number of amendments concerning plot ratio controls were adopted by the Building and Town Planning Committee. These amendments included also 25% cap as a maximum bonus in addition to the base plot ratio. In September 1969, prompted by the precedent of BHP House, the set of circumstances for which a plot ratio bonus could be granted in building applications was expanded by the City of Melbourne (Table 4.1).

This amendment was introduced in conjunction with a minor review of the zoning allocations. The zone C, the one with the highest ratio of 12, was extended to include all the blocks contained between Russell and Spencer Streets and Collins and Flinders Street. This rationale of the amendment was motivated for the proximity to public

transport facilities, and thus suggested the establishment of a preferential axis for future high density development along the southern side of the eastern end of Collins Street.

Pressure to amend building regulations happened also from different perspectives, but to no avail. In 1970, a proposal to amend the existing planning scheme to reduce plot ratios in the city was contemplated at the Melbourne and Metropolitan Board of Works (MMBW) and created immediate controversy. Melbourne's most influential property owners opposed vehemently this initiative. Subsequently, property owners coalesced into the Building Owners' and Managers' Association (BOMA) and managed to influence the Board obtaining to retire the proposal of amendment.⁸⁸ The principal aim of BOMA was "to represent the owners and managers of buildings in the many spheres where collective thought and action would be beneficial to their interest".⁸⁹

Circumstances for allocation of plot ratio bonus	N (1964)	N (1968)
Building with all its frontage set back from the alignment of a street or a lane	8	8
Setback, min. 20 feet, and public forecourt maintained for pedestrian access	8	8
Building at an intersection providing a concourse in the opinion of the authority	n/a	8
Arcade or passageway, min. 18 feet wide, open to the public during business hours	4	4
Ground floor set back, min. 10 feet, to form a footpath for the pedestrian public	6	6
Building respecting alignment at intersection and setback on internal boundaries	n/a	8
Building comprising two or more flats subject to Council opinion	n/a	0.5

Table 4.1

List of urban design strategies ('circumstances') according to which a plot ratio bonus was available according to the City of Melbourne Planning Scheme of 1964 (first release) and of 1968 (amendment following precedent of BHP House); N is the multiplying factor of the formula: Plot Ratio Bonus = (a / A) x N, where 'a' is the area of the public space benefit provided by the project and 'A' is the site area.

4.4 Rentable and rateable

Block busting and the decade of the square tower

Collins Place

In addition to a considerable portfolio of land and properties owned at the western end of the CBD, the Australian Mutual Provident Society possessed a number of land parcels along Collins Street. A number of these plots were concentrated in the block bounded by Exhibition Street, Flinders Lane and Spring Street. There, from the late

⁸⁸ Leonie Sandercock, "Melbourne: Capitalism, Crude and Uncivilized," in *Cities for Sale* (Melbourne: Melbourne University Press 1975): 145-75.

⁸⁹ "New property group to query planning change," *The Age*, August 1, 1970, 8.

1960s, the insurance company started an unprecedented project of land consolidation. AMP was helped in the operation by real estate agents Richard Ellis Sallman and Seward, and by the direct involvement of the senior partner Tony Sallmann, who, on behalf of AMP, handled directly the delicate task of negotiating in secrecy with a multitude of proprietors.⁹⁰ In 1969, after a lengthy operation of land purchase, AMP consolidated under one title, at 17-33 Collins Street, land acquired from twelve separate owners, including the purchase of five leaseholds. In the same year, the insurance company entered into a development agreement of this conspicuous property with Mainline Corporation, which at the time was a leading head contracting company in Australia.⁹¹

The Australian and New Zealand Banking Group (ANZ) owned an adjoining large parcel, at the corner of Collins and Exhibition on which the Bank was eager to build new headquarters in Melbourne. Given the recent operation of consolidation accomplished next door, the bank seized the opportunity to benefit from the financial resources of the insurance company, and entered into an agreement to develop the land in a joint-venture with AMP.

The sites of AMP's and ANZ combined created the condition for the largest real estate development ever undertaken in Melbourne's CBD: a plot of land of over 137,000 feet in the most prestigious commercial address of the city; the so-called 'Paris End' of the grid, at the south-eastern end of Collins Street. Bates, Smart & McCutcheon were consulted by AMP to carry out a preliminary feasibility study, which revealed that, after plot ratio calculations, the large amount of office space would be of such entity to self-generate real estate opportunities suitable for retail and a premium high-rise hotel.⁹²

The design of Collins Place was inspired by a number of large mixed-use precedents from other cities worldwide, and was commissioned to the New York-based firm of I.M. Pei and Partners, which had renowned and demonstrated capacity to handle projects of similar size and scope. The danger that a development of such a large scale might destroy the variety of the activities of the Paris End was recognised and Pei and

⁹⁰ "Beneath the Big Top," *The Age*, May 18, 1981, 25.

⁹¹ Richard Ellis Sallmann & Seward, "Feasibility Study and Market Analysis," 2-3.

⁹² Rico Bonaldi, interview, 1 September 2014.

its planning consultant Vincent Ponte stressed their aim to implant in the CBD a urban precinct able to generate a “microcosm” with its “own environment”.⁹³ The urban design concept followed an established American model of development based on the creation of mutually reinforcing activities; with an office building bringing clients to the hotel, banking bringing clients to shopping, and shopping to banking, the complex aimed to create a whole greater than the sum of its parts.⁹⁴ The design team indicated Place Ville Marie in Montreal, Australia Square in Sydney, the Prudential Center in Boston, Main Place in Dallas, and the Rockefeller Center in New York as successful and inspiring precedents for Collins Place.⁹⁵

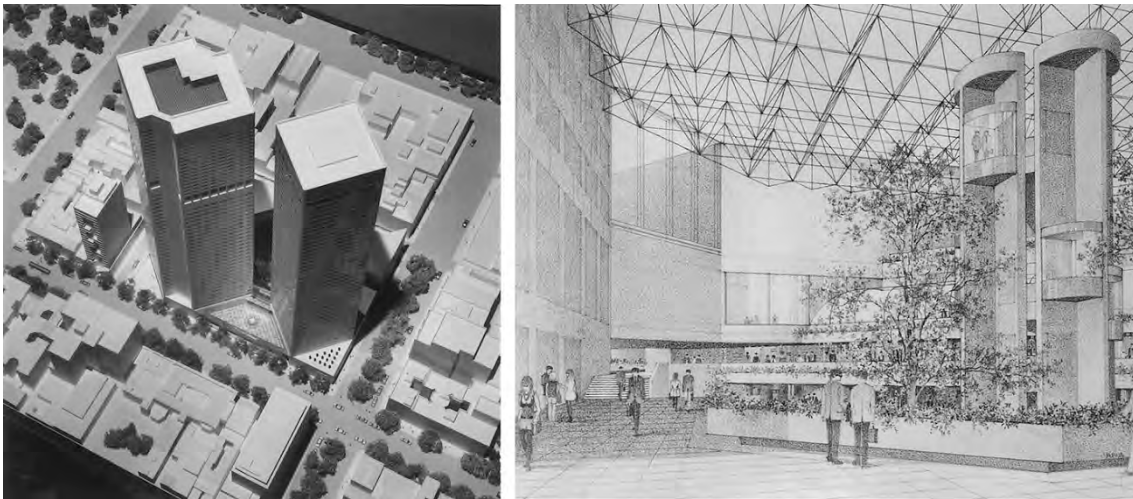


Figure 4.16

Collins Place, 35-55 Collins Street; model and perspective of the Great Space, 1971

The Great Space

The overall scheme had its fulcrum on a diagonal alignment that created a triangular forecourt surrounded by a sky-lit shopping promenade. This triangular indoor plaza, baptised as the “Great Space”, was proposed to the planners as an emulation of Melbourne’s arcades. The Great Space combined modern air-conditioned urban indoors with the traditional *grandeur* of Italian gallerias. The designers promised to give pedestrians “refuge from Melbourne’s mercurial climate” in a space surrounded by a

⁹³ Vincent Ponte, “Planning,” in I.M. Pei and Partners, *Collins Place Development Plan*, 12.

⁹⁴ Ponte, 12.

⁹⁵ I.M. Pei and Partners, *Collins Place Development Plan*, 5.

“continuous interweaving system” of three levels of pedestrian circulation.⁹⁶ In response to the City of Melbourne’s concerns for urban congestion, Pei and Ponte proposed an efficient organisation of vehicular access, combining loading bays with an underground car park entrance from the rear of the development in Flinders Lane. Furthermore, Collins Place was proposed as the “initial hub of a new kind of city centre”. The block-wide project included an allowance for a future underground pedestrian network envisaged to connect to the other side of Collins Street.⁹⁷

The under-cover plaza of the Great Space was indeed a form of public space that was never before seen in the city. The novelty was such that consideration of a public open space of that size was not contemplated by the Planning Scheme. In 1971, the City Planner received a query submitted by the local architects in order to resolve a matter of ambiguity about the allocation of plot ratio bonuses for the Great Space. The Town Planning committee conceded that a bonus factor of 8 as equivalent to “any other plaza” was the appropriate bonus allowance for the Great Space at Collins Place.⁹⁸

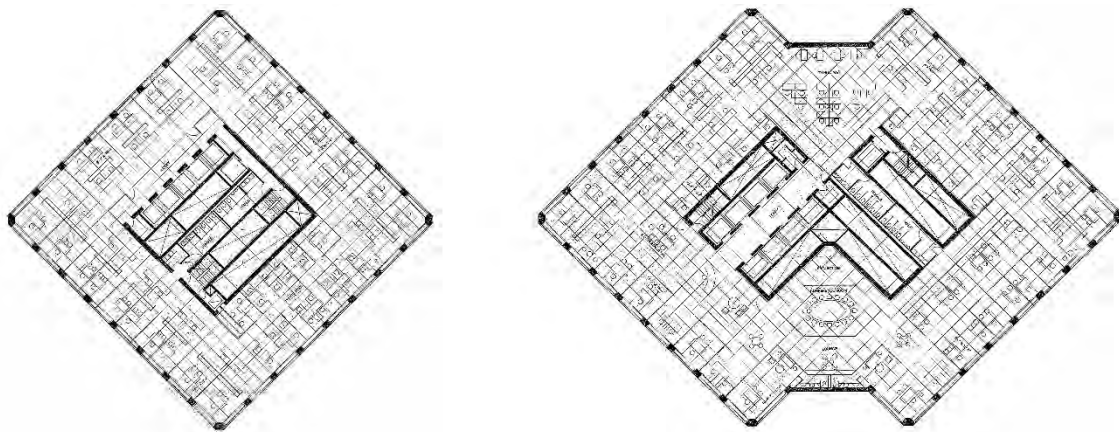


Figure 4.17
Collins Place, typical low rise office floors, 1971

The high-rise component of the development consisted of two towers: ANZ Tower, the bank headquarters, and Collins Tower, the mixed use component with offices in the

⁹⁶ I.M. Pei and Partners, 9

⁹⁷ I.M. Pei and Partners, 11.

⁹⁸ PROV, VPRS 8945/P2, unit 201, Building and Town Planning Committee, minutes 71/4765/330, [1971-72].

lower part and hotel in the upper part. The two towers were conceived to give a compelling impact on the skyline, using the natural elevation of the site. The design was informed by “performance, identity and economy of means”.⁹⁹ Both towers were oriented at forty-five degrees in relation to the street. The diagonal arrangement formed a giant “portal”, and increased the building frontage to 1,300 feet - as opposed to the 460 feet of frontage available along Collins Street.¹⁰⁰



Figure 4.18

Collins Place, perspective view, 1977 and Wentworth Hotel advertising, 1981

Following on from the success of AMP Square and BHP House, ANZ tower was the third American-designed record-breaking square plan skyscraper. The ANZ tower grew to 600 feet above ground with forty-two floors of office space. Floor plates were typically 11,000 square feet floor providing a total of 462,000 square feet. The footprint of the tower was a perfect square of 118 feet sides served by a centre core. The floor

⁹⁹ Ponte, “Planning,” 3.

¹⁰⁰ Ponte, 3.

plan was organised on a tight modular control based on four feet and eight inches. The very compact service core, with a straight-row of external banks of lifts, gave a layout that enhanced net-to-gross efficiency for the upper floors, although at the expense of flexibility of subdivision at the lower floors.

The typological newness of Collins Place was the mixed-use tower Collins Tower, which merged two square footprints into an 8-shaped floor plate of 18,000 square feet. The lower two-thirds of the tower were speculative rental space. With a combined total net lettable area of 543,400 square feet, Collins Place gave the largest office area available in a single building and the largest floor plate available in Melbourne, reflecting ideas from overseas about *burolandschaft* office design. By the same token, the hotel could capitalise on additional perimeter available from the eight-shaped floor plate; rooms were laid out around a sky-high atrium and, due to the forty-five degrees orientation of the complex, panoramic views were available for every guest.¹⁰¹

Strategic vacancy

Collins Place, set the precedent in Melbourne of privately-driven redevelopment at a block-wide scale, which signalled, albeit involuntarily, the absence of a strategic overlook for the development of the city. In 1971, during a visit to Melbourne, Henry Cobb, the design architect of Collins Place from I.M. Pei, intervened on the debate to initiate a strategic instrument of planning for the City of Melbourne and hinted at deficiencies in the regulatory framework of the time:

(...) I don't think Melbourne can afford to wait for its strategy plan – action needs to be taken now to preserve the streets [...]. In five years' time, most of the major buildings will have to be completed and the plan will be useless. [...] In Fifth Avenue [in New York] architects are encouraged to diversify their buildings at ground level with shops, restaurants and theatres, and for this they obtain the right to build extra office space. [...] It is not enough to gear planning regulations to open space and plazas, because too often you end up with empty plazas. There must be a basic attraction like shops, to keep people in the city and to keep it alive.¹⁰²

One year earlier, the City of Melbourne had initiated a process for the creation of a larger instrument of planning, aimed at identifying challenges and solutions, at a metropolitan scale, for the future development of the city and its suburbs. The

¹⁰¹ Wentworth Hotel advertisement, *The Age*, May 8, 1981, 16.

¹⁰² "Look after Collins Street says U.S. architect," *The Age*, November 23, 1971, 2.

preparation of this plan, the “Strategy Plan”, was commissioned in 1972 to Interplan, a multi-disciplinary international team of planning consultants.¹⁰³

The Strategy Plan, was completed - earlier than envisaged by Cobb - in November 1974 with Interplan’s release of the “Final Strategy Plan and Action Plans”. By contrast, the completion of Collins Place, initially planned for 1976,¹⁰⁴ was delayed until 1981, firstly due to the bankruptcy of the initial head contractor, Mainline,¹⁰⁵ and then due to ensuing industrial disputes, which affected E.A. Watts, the second and final contractor of the project.¹⁰⁶

The Strategy Plan stated some of the priorities of the City of Melbourne, which relied “more than ever before” on office development as the “basic capital investment of the city” and the most important source of employment of the metropolitan area.¹⁰⁷ The city’s reliance on the production of office space was supported by the need to fund infrastructure projects, particularly the underground rail loop.¹⁰⁸ The means through which the City aimed to support these expenditures was its land taxation system, which was geared to stimulate creation of net lettable area:

(...) the critical importance of the CBD to present and future rate revenue is obvious and the ability of the City to meet proposed future commitments in the light of inflation and an improving level of services, depends very largely on continued increase in the total net annual value within the CBD.¹⁰⁹

Between 1969 and 1973, office space alone, was responsible for 55% increase of this rate revenue in the CBD. Estimating an average income of \$7 per square meter, the Strategy Plan elaborated that new office buildings alone, were capable of increasing significantly the existing net annual value of properties, and they could guarantee the adequate level of rate increase for years to come:

It is apparent that the present oversupply of office space is slowing down or even stopping completely the increase in office rentals [...]. Thus, despite the present inflationary pressures in the economy [...], increases in net annual value may not

¹⁰³ Interplan and City of Melbourne, *Strategy Plan* (Melbourne: Melbourne City Council, 1974).

¹⁰⁴ “Design and Construction Schedule”, in Pei and Partners, *Collins Place Development Plan*.

¹⁰⁵ “Liquidator now for Mainline,” *The Age*, September 12, 1974, 10.

¹⁰⁶ “Sparkling monument to a nine-year task,” *The Age*, May 18, 1981, 24.

¹⁰⁷ Interplan and City of Melbourne, *Strategy Plan*, 51.

¹⁰⁸ Interplan and City of Melbourne, 324.

¹⁰⁹ Interplan and City of Melbourne, 326.

continue at quite the high rate as the past four years. Nevertheless the rate of construction of new office space guarantees that the market demand for new accommodation will be fully satisfied so that a strong rate can be expected in rentable and rateable space, even if the growth rate in rent levels is reduced in the short term. It can also be noted that office buildings under construction will be subject to rates regardless of the degree of occupancy.¹¹⁰

The square tower

Following AMP Square, BHP House and Collins Place, the City's quest for CBD net annual value continued, fuelled by a widespread diffusion of the new typology of large office developments: monolithic square – or quasi-square – towers with centre core.

In the 1970s, tall office buildings continued to proliferate shifting westwards the centre of gravity of business in the CBD, where the commercial network of tertiary employment in the city expanded. At 566-574 Bourke Street, on a site adjacent to ACI House, the thirty-storey, quasi-square building of Marland House [Map 1D, 42] was developed by the British-Australian joint venture of Abbey Capital and T&G Mutual Life.¹¹¹ Between 1976 and 1977, the property on the southern boundary of BHP House, at 114-116 William Street [Map 6A, 51], was designed by Yuncken Freeman as another squarish free-standing tower. The project was developed by Australian Estates, a real estate investment subsidiary of the diversified Australian corporation CSR.¹¹² Two peripheral examples of quasi-square monoliths of the times include Celsius House in Lonsdale Street [Map 4A, 48] and Myer House in Elizabeth Street [Map 3C, 57].

The design of the State Bank Centre [Map 6B, 60],¹¹³ the headquarters of Swiss-Re in Queen Street [Map 6C, 52],¹¹⁴ Collins Wales House in Collins Street [Map 6B, 59], and the octagonal variation of Nauru House at the corner of Collins and Exhibition Street [Map 8A, 56], relied – with some variations on the theme – on the consolidated model of column-free space on four sides in an approximately 120 feet square footprint served by a centre core.¹¹⁵ The spatial dictates of the monolithic square tower were very resilient, and capable of informing schemes for the same project presented by different architects. In one instance, the square plan tower spread beyond the CBD, in St Kilda

¹¹⁰ Interplan and City of Melbourne, 327.

¹¹¹ Cityscope, map 19, property 48.

¹¹² Cityscope, map 28, property 2.

¹¹³ "43-Storey State Bank Centre," *Architecture Today* 14, no. 9 (October 1972): 5.

¹¹⁴ Mahlstedt, map 18.

¹¹⁵ "Nauru to Build Tower," *Architecture Today* 14, no. 6 (July 1972): 7.

Road, at Southpoint Development, designed in 1972 by McIntyre McIntyre and Partners.¹¹⁶

In 1965, proposals for the redevelopment of the city block bounded by Swanston, A'Beckett, Elizabeth and La Trobe Streets – opposite the later Melbourne Central – were sent in response to an open design competition promoted by the Melbourne City Council and the RVIA. The first scheme, awarded to Leith and Bartlett, had a 48 storey mixed use square tower as its centrepiece, where office floors were complemented by apartments (see figure 4.19, left);¹¹⁷ the theme of square plans emerged also in other projects, including one submitted by two emerging architects who would later play a prominent role in the city, Daryl Jackson and Evan Walker.¹¹⁸ The square tower could also fulfil the purpose to provide outstanding recognition in architectural education. Brian Mathieson, a graduate of the Royal Melbourne Institute of Technology, was awarded the RAIA Silver Medal, “for student work of the highest standard” done with a ‘case study on urban living’, where slender square plan towers counterbalanced medium density housing in Carlton.¹¹⁹

In the early 1970s, monolithic square towers were a model of choice in a number of block-wide projects of the city, which remained unbuilt. A scheme for City Square Development in Swanston Street was submitted by British developer Star Holdings with the design of E. & G. Kolle Architects (see figure 4.19, right). The project, planned to commence in 1972 and complete in 1975, was the object of controversy after negotiations with authorities imposed to reduce the height of the tower.¹²⁰ The initial scheme was a quasi-square 53 storey tower of reinforced concrete clad with dark glass. Reflecting civic trends for mixed use development, as established by AMP Square and Collins Place, office space was complemented by 24 levels of hotel accommodation in the tower and a six storey block with conference facilities.¹²¹

¹¹⁶ SLV, Stephenson and Turner Archives, Drawings collection, Office Buildings, “636 St Kilda Road, Melbourne, Retrofix and Landscaping,” architectural drawings, 1984.

¹¹⁷ “Civic Design Competition, Melbourne 1965,” *Architecture and Arts* 13, no. 9 (September 1965): 20.

¹¹⁸ “Civic Design Competition, Melbourne 1965,” 26

¹¹⁹ “RAIA Silver Medal 1967,” *Architecture in Australia* 56, no. 4 (December 1967): 953-954.

¹²⁰ Robin Boyd, “Big city with little ideas,” *The Age*, October 20, 1970, 5.

¹²¹ “Civic Square Development. Melbourne,” *Constructional Review* 43, no. 3, (August 1970): 36-37.

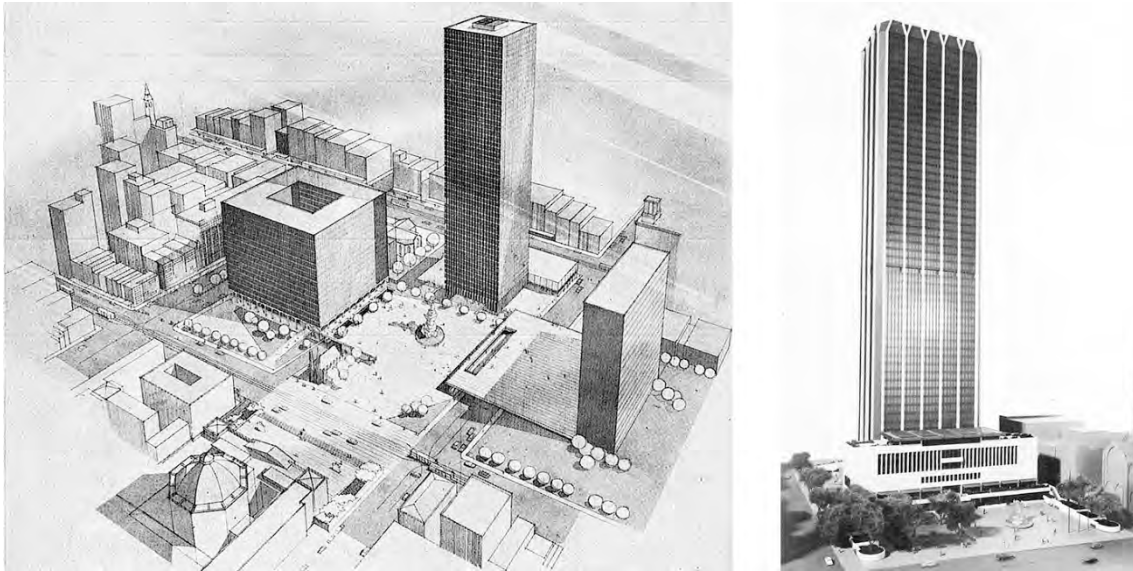
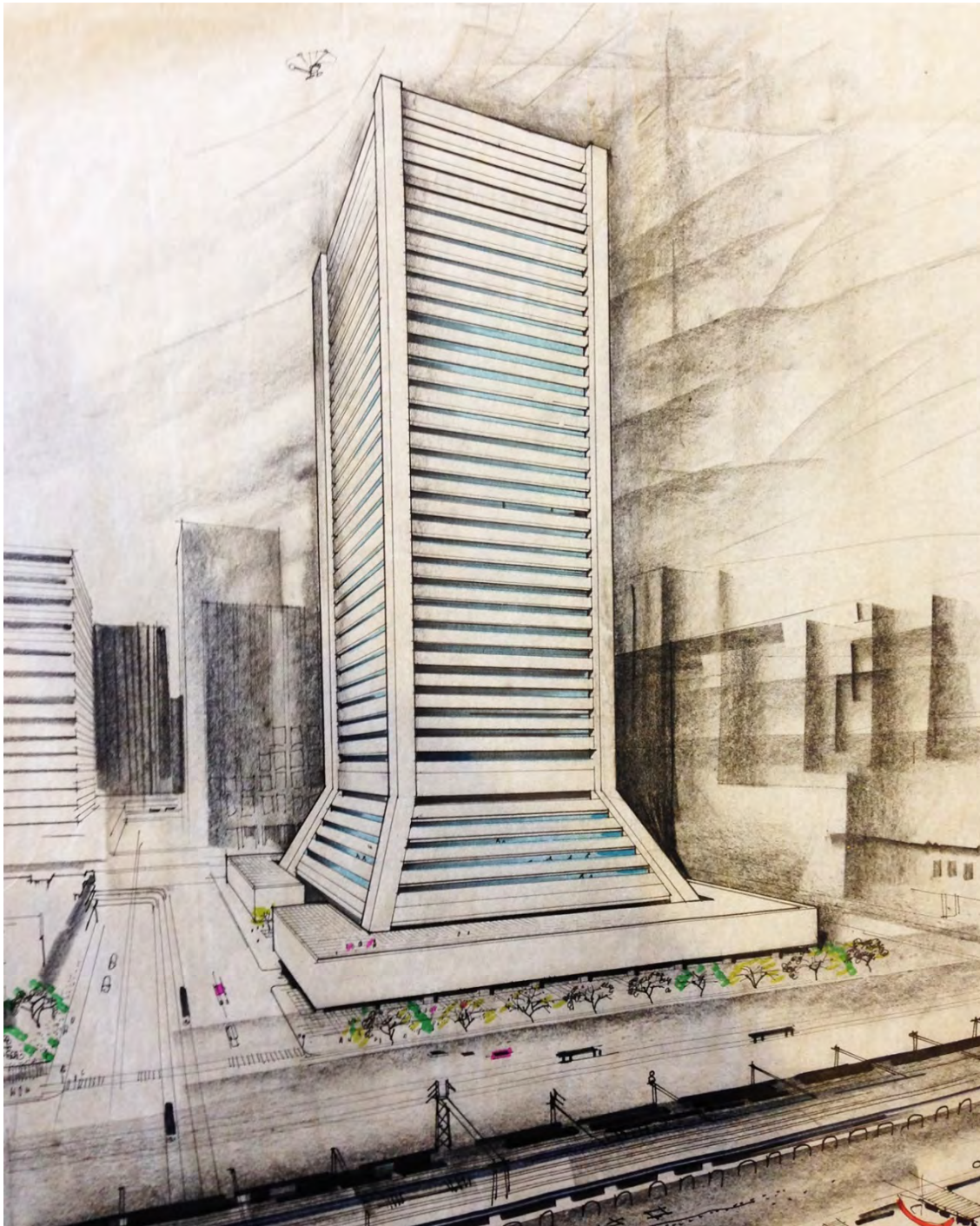


Figure 4.19
Unbuilt civic projects in Swanston Street, Melbourne: Civic Centre competition, winning scheme by Leith and Bartlett, 1965 (left) and City Square Development designed by E. & G. Kollé, 1970 (right)



Figure 4.20
Merchandise Mart, Hotel and Office Development, designed by Stephenson and Turner (unbuilt), Spencer Street, Melbourne, undated [1960s]

**Figure 4.21**

Speculative office project, designed by Stephenson and Turner (unbuilt), Market Street, Melbourne, 1960s

Several unbuilt feasibility studies, commissioned to Stephenson and Turner between the mid-1960s and the mid-1970s, indicate that many more monolithic towers may have followed, but only remained in the imaginary repertoire of developers, public

institutions and Melbourne's architects. Two schemes for the Victorian Railway head offices complex, also known Merchandise Mart (see figure 4.20),¹²² a speculative office project on Market Street (see figure 4.21),¹²³ and the scheme for the Princess Theatre Redevelopment on Spring Street,¹²⁴ suggest the likely outcomes of many major city redevelopments, if these had proceeded beyond the sketch design phase.

Polemics

In the background of this proliferation and dominance of monolithic square plan towers, criticism and lack of satisfaction with the state of architectural developments in the city grew in particular among some local architectural elites. To some commentators, it appeared that Melbourne had in part failed to adapt successfully with the most progressive architectural trends given by modern urban development.

Disenchantment with the state of things about modern architecture in Melbourne was initiated by Robin Boyd, who had earlier commented about the progressive involution from orthodox modernism into an ethos of "hundred images and thus no image".¹²⁵ In the early 1970s Boyd stated that, after the 1956 Olympic Games, Melbourne had not stepped up to the challenges of the times. This dissatisfaction was expressed with a speech given in occasion of his election as president of the chapter of RAI Victoria:

(...) to make a controversial building more acceptable here one cuts it down to size ... Melbourne's size. An astute developer in Sydney, wanting to make a controversial proposal more acceptable, would promise to add 10 storeys to it. Sydney (...) is set on a wild height climb – 60, 80 storeys proposed. It's out to beat the Empire State Building, or bust. Height alone is a juvenile aspiration, although it is a good thermometer of civic temperature. But we all know that height is not all that Sydney has today over Melbourne (...). Australia Square is a lot more than high. There is a changed, charged atmosphere in the front rank of Sydney's architects, developers and Government builders.¹²⁶

A different kind of criticism emerged later in the decade, which was focused against the pervasive high rise projects of the 1970s. This antagonism culminated in polemics

¹²² SLV, "Merchandise Mart Hotel and Office Development," n.d. [1970?]; "Victorian Railways Railway Head Office Complex, Spencer Street, Melbourne (Project Mart; Project 'R')," 1971. Architectural drawings, 072/05.

¹²³ SLV, Stephenson and Turner Archives, Drawings collection, Office Buildings, "Market Street Development – Speculative Office Project, 196-" [1960s?].

¹²⁴ SLV, "Office/Theatre Development, 157 Spring Street (Princess Theatre Site)," 1966.

¹²⁵ Robin Boyd, "Decade of change," *The Age*, March 29, 1965, 13.

¹²⁶ Robin Boyd, "Big city with little ideas," 5.

fuelled by Norman Day, the architectural critic of *The Age*, and by architect Neil Clerehan, the editor of the RAIA Victorian Chapter's journal *Architect*.

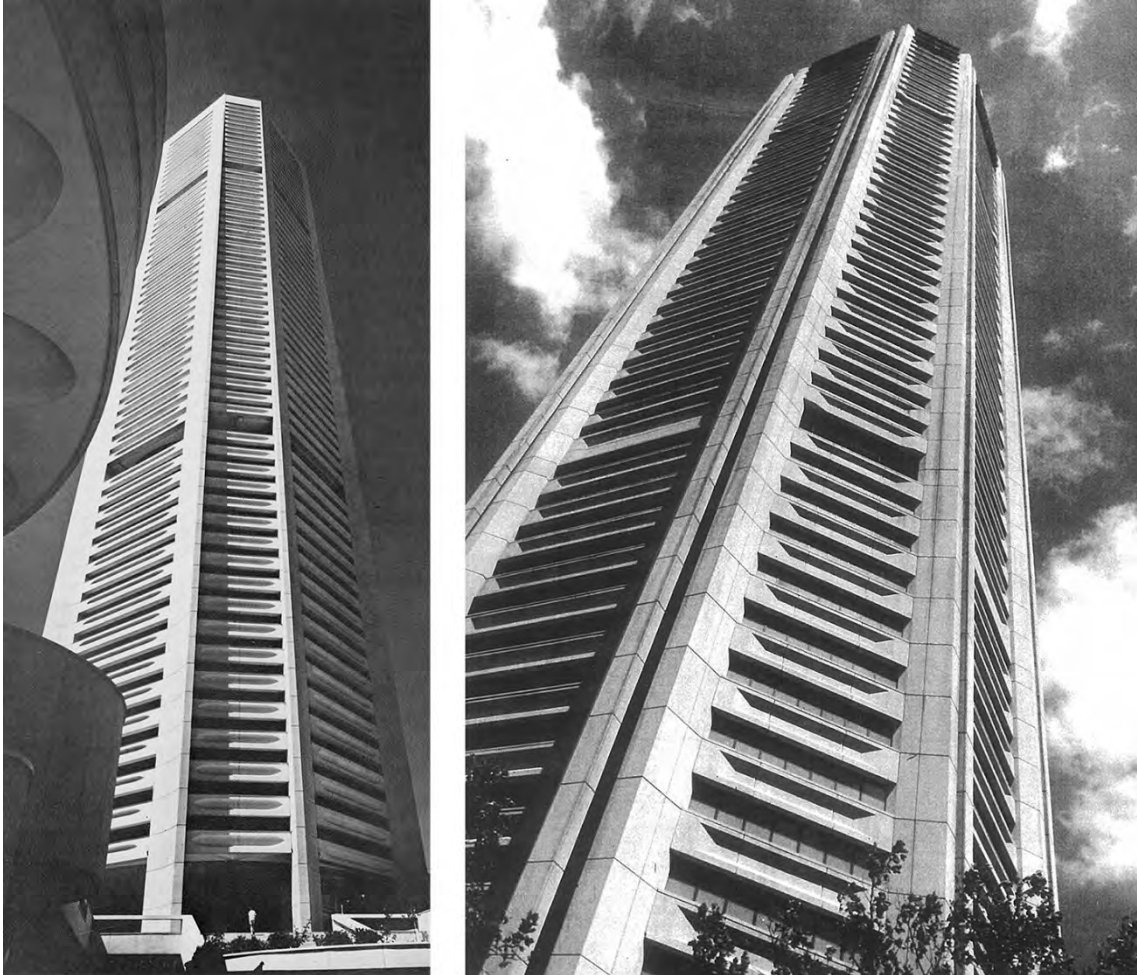


Figure 4.22

MLC Centre, Sydney, 1971-77 (left) and Nauru House, 80 Collins Street, Melbourne, 1972-77 (right)

Polemics converged in particular on Nauru House, which *Architect* epitomised as a “monster building”, a “hunk” guilty of being the product of an “octagonal (or hexagonal) plan that just keeps rising” and that, according to the Victorian journal of the RAIA, it seemed “to give nothing to our city save a large immutable blob, unnecessary extra accommodation”.¹²⁷ Architectural criticism escalated into vehement controversy once Clerehan made remarks on *Architect* about the design attribution of the project, which suggested that both Nauru House and Sydney’s MLC Centre, due to a close

¹²⁷ “Nauru House: a Gift,” *Architect* 4, n. 40 (March 1976): 15.

resemblance, were buildings orphaned of architectural authorship.¹²⁸ The polemic, reached the general public on the newspapers,¹²⁹ and following distress and indignation expressed by Harry Seidler,¹³⁰ the architect who designed Sydney's MLC Centre, the Victorian journal of the RAIA had to present a public apology.¹³¹

Conclusion

Between 1965 and 1980, the Central Business District of Melbourne continued to change the skyline with a new generation of multi-storey office buildings that had been initiated a decade earlier. The most notable skyscrapers of the time, continued to be prompted by corporations eager to occupy newly-built, prestigious multi-storey premises. Among these corporations, insurance companies maintained the largest share of owner-occupied initiative, and one in particular, AMP, emerged as the leading institution that promoted real estate development in Melbourne. Among others, banks, government and investment funds started to commission buildings for owner occupancy, but a growing share of tall building activity of the time was taken by projects initiated simply on a speculative basis. (See appendix F, tables F.11, F.12)

By the early 1970s, this second wave of tall construction activity coalesced into a new cluster of towers on the western side of the CBD, in the surroundings of the intersection of Bourke and William Street. Collins Street also continued to be transformed, where new office blocks carried on the process of annihilation of the historic streetscape with new infill blocks, squarish towers or side-core slabs, although the latter were more compact and less elongated than in the past. Development activity in Collins Street peaked in the 1970s at Collins Place, on the eastern end of the street, where an entire block of land was consolidated and cleared for a large multi-functional development driven by ANZ's need to build new headquarters and supported by a speculative mixed-use development financed by AMP.

From the late 1960s, tall office buildings development affected lands of larger size than in the past - on parcels not smaller than 1,000 square metres - and often as a result of

¹²⁸ Neil Clerehan, "A Tale of Two Houses: Nauru and Wood and MLC too," *Architect* 4, no. 49 (September 1977): 7, 9.

¹²⁹ "Who is the father of these twins?" *The Age*, October 21, 1977, 17.

¹³⁰ Rico Bonaldi, interview, 1 September 2014.

¹³¹ "Correction and Apology to Mr Harry Seidler," *Architect* 4, no. 50 (November 1977): 7.

large operations of consolidation that would, most frequently, range between 1,500 and 4,000 square metres. The use of the land intensified as a result of new built-form controls and zoning regulations that prescribed a plot ratio of up to 12 for the commercial zones of the grid located in closer proximity of train stations. Based on the total amount of net lettable area produced, tall office buildings of the late 1960s and 1970s developed larger blocks of land with buildings larger than in the past. (See appendix F, tables F.2, F.3)

New office towers continued to cluster on the western side of the grid in response to market attitudes that saw centralisation within high-rise hubs as a business advantage. These attitudes were reflected typologically in the preference for free-standing towers on 'island' sites that could provide higher, larger and better quality office space than the smaller side core slabs of the first post-war generation. Furthermore, the new generation of buildings reflected changes in planning policy, urban design control and models of commercial development, which had been implemented and encouraged vigorously by the City of Melbourne in the second part of the 1960s.

These models of urban regeneration advocated the provision of open space at street level as a mean to decongest the inner city and to enhance the urban life experience with civic monumentality and recreational opportunities for pedestrians. The new controls were aligned with a physical planning vision of the city, which deliberated that the topographically higher ends of the CBD would be the ideal plateau where major tall office buildings could experiment and prosper.

The trends for *ad hoc* modification of the regulations triggered by single projects, which began in the 1950s, continued to occur, notwithstanding the existence of a new set of development controls given by the 1964 Central Area Planning Scheme. Following the introduction of plot ratio zoning, pace-setting tall office buildings, like BHP House and Collins Place, helped to fine-tune subtle mechanisms of control for which bonuses to plot ratios could be assigned. The first Planning Scheme was followed by the first Melbourne Strategy Plan in 1974, which confirmed the critical importance of new tall office building activity as a source of revenue required to plan and backup financially

the development of the city's strategic infrastructure projects, namely, above all, the underground railway loop.

The architectural instrument with which the city grew annual values was a building type that developers and architects began to experiment upon in the early 1960s, the centre core square plan tower, a type defined by key architectural quantities. As leading quantity surveyor Harry Wexler indicated, these quantities were a 120 feet square footprint with 40 feet span from core face to external wall and typical floor plate of 12,000 to 13,000 feet of net lettable area. This model started in Melbourne with pace-setting projects like AMP Square and BHP House (125 feet wide). Soon after, other dominant monolithic silhouettes emerged in the city's skyline, with a trend to grow larger in footprint in some examples, such as at Capital Tower (131 feet wide) and the double-square eight-shaped Collins Tower in Collins Place.

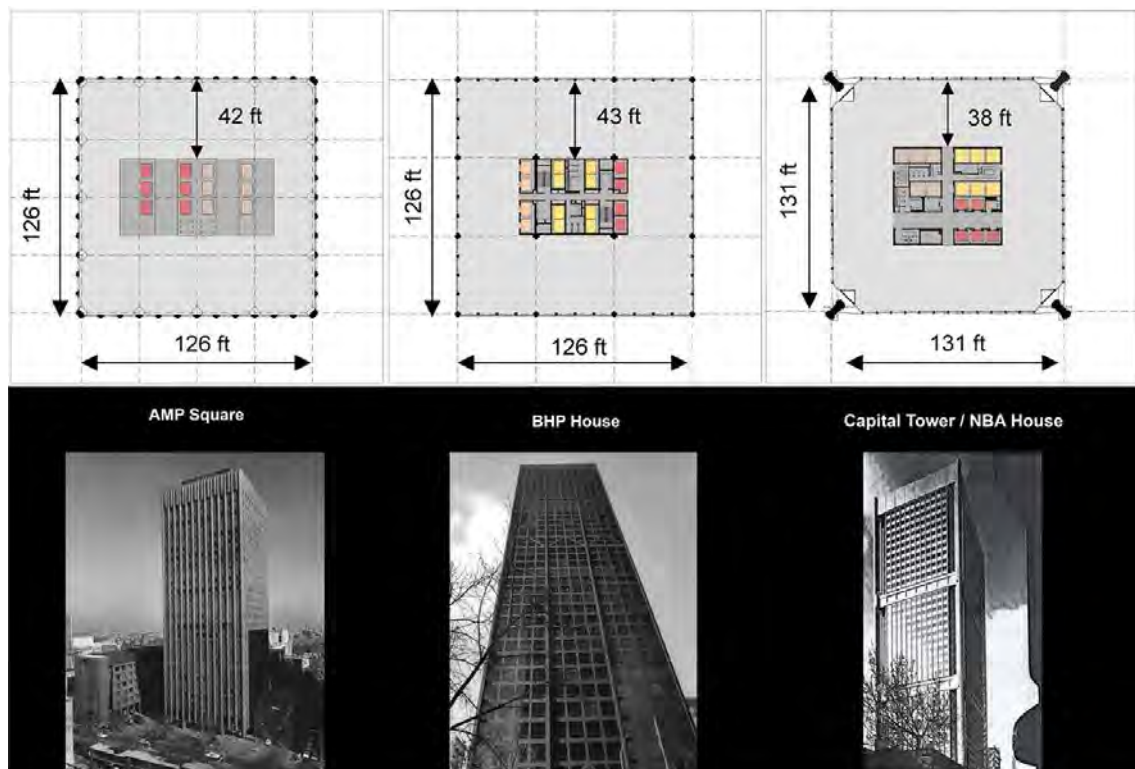


Figure 4.23
AMP Square, BHP House and Capital Tower, typical floor plan comparisons

Ultimately, the square tower was the commercial consensus of the 1970s, where optimal rentability and spatial quality were met due to lettable area size, open space, location of

lifts and stairs and flexibility circulation through the core and all-round access to views. On the one hand, the square tower provided the best - or at least the most reliable rental prospects –for private “prestige” associated with building height. On the other hand, it secured prospects of valuation growth that could support, through tax revenue, the construction of the city’s infrastructure.

Land consolidation and net annual value increase of the city’s building stock continued during the 1970s, in a context of obliviousness of heritage significance, which encouraged the destruction of the older streetscapes of the city. Continuity of means and methods of planning and urban development were accompanied by a rising perception that tall building developments of the city were an unfitting architectural practice. Criticism and dissatisfaction with these developments grew particularly in the second half of the 1970s. But this cultural shift, which in part had triggered the realisation of the 1974 Melbourne Strategy Plan, had to wait for the next decade to see tangible outcomes that were explicitly endorsed by the government and its urban development authorities.

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Chapter 5

Oversupply (1980-1995)

The bull market and the “Big Six”

Very early on, I decided I was going to hate the Rialto. As the central core went up, up, up at the rate of better than a floor a week, it was a great phallic symbol at the money end of Melbourne's Collins Street. [...] Then came the indigo reflecting glass, creeping up floor by floor. [...] Since then, along with many of my friends, I have noticed something else: it is Melbourne's Ayers Rock. In the early morning, it is deep pavement grey; as the light becomes brighter, it is all indigo. But then it can go white with the clouds, paler blue reflecting the sky. And magic takes over if there is any sort of a sunset. It becomes gold all over and some nights even turns to the colour of blood. Please forgive me: I repent. As an ultimate God-Preserve-Collins Street Greenie, I am beginning to love the Rialto.

Keith Dunstan, 1985.¹

From the 1980s until the mid-1990s, tall office building activity in Melbourne entered a stage of entrepreneurial excess. In parallel, the city went through strategic changes of policy and philosophy of urban transformation, which were reflected in the assessment of large projects. Changes, adjustments and modifications pertained to means and ends of real estate development, and these new instances exploded in the CBD into an oversupply of office space driven by tall buildings. Although these transformations culminated in a peak and downturn of unprecedented proportions, these changes developed gradually in the first half of the 1980s before exploding with a short burst of activity in the second half of the decade.

At the end of the 1970s, the net annual value of building applications grew slightly and building activity was almost stagnant. By contrast, the 1980s opened with a sudden increase of building applications. Despite a high inflationary rate of 10%, property values increased annually at a rate of 35%. From 1981 to 1983, the completion of one large office

¹ Keith Dunstan, “Why I love Melbourne's Ayers Rock,” *The Age*, September 5, 1985, 23.

project alone - the Rialto Towers - inflated the total net annual value of all building applications from \$157,900,000 to \$348,600,000.²



Figure 5.1
Melbourne, aerial view, 1996

In the early 1980s, office space supply increased also due to the completion of two other major projects: Collins Place [Map 8D, 54, 55] and State Bank Centre [Map 6B, 60], which were opened, respectively, in 1981 and 1983. Together, the two projects added to the existing office stock of the city another 158,000 square metres of net lettable area and, although conceived in the early 1970s, they were delayed due to inflationary pressures, uncertain market conditions and industry-wide disputes among construction workers.

Despite this backlog from the previous decade, the construction of new tall office buildings in Melbourne accelerated in the 1980s, when more office buildings were built than ever before. In 1982, the city had a little less than 3.2 million square metres of office floor area. In 1987, office space grew to 3.6 million square meters and, by 1992, over 4.8 million

² PROV, City of Melbourne, VPRS 8945/P2, Building and Land Use Committee, Unit 224, Letter of the Director of Building to the Chairman of the Building and Land Use Committee, subject: "Value of Applications Received for Building Approval – Building Surveyor's Branch," 15 March 1985.

square metres. In only five years, the city produced more office space than the stock supplied from its foundation until 1965.³ [See appendix C, tables C.1, C.2]

In the 1980s, the construction of new office buildings was accompanied by a period of economic prosperity and appeasement of construction disputes, after industrial conflicts had peaked particularly in the mid-1970s. In 1974, for example, the Victorian construction sector lost 574,500 days of work; in comparison, the worst scenario of unrest of the next decade occurred in 1983, when only 60,600 days were lost due to strikes among construction workers. Nonetheless, both decades shared problems of strong inflationary trends that peaked in the early 1980s and were reflected by rising building wages for site labour and steady cost increases of building materials. [See appendix C, table C.11]

Yet, employment did not grow proportionally to office floor space. In ten years, white collar employment in the CBD grew only from 109,000 employees in 1977 to 115,200 in 1987. In twenty years, Melbourne's office floor space *pro capita* increased gradually: from the 13 square metres per employee in 1967 up to 31 square metres per employee in 1987. A share of this increase was likely due to the introduction of information technology, which triggered globally the need for more workspace.⁴ But ultimately, vacancy rates from the late 1970s to the 1980s show that office developments in Melbourne entered a stage of extraordinary oversupply. In 1977, at the peak of a glut, the average vacancy rate in Melbourne was 17%; in late 1992, vacancy rates had grown to 27%.⁵ [See Appendix C, table C.2]

The economic prosperity of the 1980s and early 1990s was subject to periods of discontinuity, which were triggered in 1983 and in 1987 by two major downturns of the Australian Stock Market. According to *The Age*, the crash of 1983 encouraged more property development. Construction and real estate were taken by investors as “the most suitable investment commodity” to refuge from strong inflation rates and high fluctuations in financial markets.⁶ Around the mid-1980s, there were clear signs that a major boom of the property market was imminent. In 1984, the Australian Building Owners and Managers

³ City of Melbourne, CLUE 1972-1987, custom data enquiry n. 8884485-v2, 17 December 2014.

⁴ Patrick Duffy, *Information Technology and Office Design: the Orbit Study* (London: Orbit, 1983).

⁵ City of Melbourne, CLUE 1972-1987, enquiry n. 8884485-v2.

⁶ “Real estate, the investor's rock against the tides of economy,” *The Age*, July 21, 1986, 3.

Association (BOMA) predicted that office accommodation would shortfall heavily in the CBD by 1988.⁷ Rumours that a “blessing” of “huge surplus funds” from Japan were about to pour in Australian city centres surfaced in the media, thus contributing to spark further enthusiasm among speculative developers.⁸

Considerable space was given by local newspapers and professional journals to report and analyse the most apparent outcome of the building boom: a third generation of skyscrapers.⁹ New skyscrapers led the way of the boom and materialised in the skyline with six large speculative office projects, which *Architect*, the journal of the Victorian Chapter of the RAI, dubbed the “Big Six”.¹⁰

Following up trends that originated in the 1950s, this new - and bigger - office boom unfolded relentlessly in the CBD. Tall buildings were taller and larger than ever before, they amplified trends of land consolidation, adapted to new urban design controls and, while conforming to novel aesthetic *dicta*, they reached a point of no return in the typological development of their architectural design.

5.1 The bull market (stage 1)

The golden days of the crystal tower

200 Queen Street [Map 2D, 61]

One of the first tall building projects of the 1980s was at 200 Queen Street, on a site of approximately 2,500 square metres at the corner of Queen and Little Bourke Streets. In late 1979, the site was acquired for \$1,400,000 by Grollo Australia, an emerging Melbourne-based and family-run entrepreneur in property and construction.¹¹ In March 1980, a town planning application for the site was submitted by architect Gerard De Preu on behalf of Grollo for a 31 storey-high office building. Later in the same year, following the consolidation with the adjoining site at 222 Queen Street, the design was amended to a 34

⁷ “Real estate, the investor’s rock against the tides of economy,” 3.

⁸ Sian Watkins, “Blessed with bargains, Melbourne gears up for a Japanese shopping spree,” *The Age*, September 9, 1987, 27.

⁹ Peter Brew, “The Right Stuff,” *Architect* 13, no. 7 (July 1988): 5-8; Tony Styant-Browne, “The Tall Building in Melbourne,” *Architect* 13, no. 7 (July 1988): 29-32; “The City Office Building: Experiments with the Second City,” *Architecture Australia* 79, no. 9 (September 1990): 54-56; Neville Quarry, “Trading Places: Mega-block Busters,” *Architecture Australia* 79, no. 9 (September 1990): 38-50; Helmut Jahn, “The Skyscraper in the Modern City,” *Architect* [Victoria], vol. 7, n. 3, July 1983, pp. 12-15.

¹⁰ Peter Georgiev, “The ‘Big Six’ Office Buildings,” *Architect* [Victoria] (August 1991): 5-11.

¹¹ Cityscope, Map 21, Property 5.

storey-high and 130 metre tall tower with 20,000 square metres of net office space. The project was approved with a plot ratio of 7.4, making use of bonuses given for building setbacks, a “cut off corner” on Queen Street, a colonnade and a passageway that connected, under a car park podium of 9 levels, Queen and Lonsdale Streets.¹²

The plan of the tower could be inscribed approximately into a hexagon. Two square cells of 20 metre sides merged into an open space formed by a diagonal cut off on the south-west corner. The typical floor was served by a diamond-shaped side core located at the rear of the property. The tower was elevated from the main street over a colonnade of aluminium-clad circular columns.



Figure 5.2

ACI House, 200-222 Queen Street, 1980-82

Soon after completion, in 1983, 200 Queen Street received the Bronze Plaque, a major award of BOMA Australia. Recognition was achieved because the building was “quickly

¹² PROV, City of Melbourne, VPRS 8945/P2, unit 214, Building and Land Use Committee, Application n. C.M. 2648, 17 March 1980; Application n. C.M. 3008, 12 June 1980.

tenanted” at higher rates than expected.¹³ Besides economic utility, BOMA recognised excellence for a structural design in concrete with space relatively free of columns, use of advanced mechanical services and a pleasing appearance of “civic worth”.¹⁴ The jury commented:

Although constructed on a ‘spec’ basis, the building proved to be sufficiently impressive to attract a major ‘name rights’ tenant well before completion.¹⁵

Naming rights for the tower, which was enveloped in a reflective double glazed curtain wall, were purchased by the ACI-Pilkington, which had recently vacated and sold the owner-built tower in Bourke Street.¹⁶

Unexpectedly, praise for the building came from the architectural critic of *The Age*, Norman Day, who, until then, upheld one-way opposition against tall office buildings in the CBD. According to Day, 200 Queen Street was the end of the “first skyscraper age” in Melbourne, the age of the “horrible mistakes” of Collins Place, NAB House, Nauru House and the redevelopment of the Rialto Precinct.¹⁷ The critic acknowledged the architect, Gerard De Preu, for combining “glamour and practicality” in a “romantic” tower of softly curved forms, and for managing to escape “the economic and legalistic compromising usually reserved for speculative office buildings”.¹⁸ The critic, however, pledged the architect in concluding his review: “Please Mr De Preu, don’t do the same thing on the Rialto site”.¹⁹

The project of 200 Queen Street was in fact a prototype, used by Grollo to test - with the same architect – the technical and formal aspects of Rialto, the largest tall building development in the city of the times.

Rialto: three towers

In 1981, Grollo Australia purchased several land parcels at the western end of Collins Street, which included a number of significant historic buildings: the Rialto Building

¹³ “Notices: BOMA Awards, December 1983,” *Architect* 8, no. 1 (May 1984): 25.

¹⁴ “Notices: BOMA Awards, December 1983,” 25.

¹⁵ “Notices: BOMA Awards, December 1983,” 25.

¹⁶ In 1982, ACI offered the property at 546-560 Bourke Street on the market for \$12,500,000 and settled in 1983 for \$8,500,000 with Jetset-Werled. Cityscope, Map 19, Property 50 [1983].

¹⁷ Norman Day, “A Towering Romance,” *The Age*, July 13, 1982, 14.

¹⁸ Day, “A Towering Romance,” 14.

¹⁹ Day, “A Towering Romance,” 14.

(1890-91), the Winfield Building (1891) and the York Butter Factory (1852). The land was pre-owned by the National Mutual Life Company. National Mutual had wanted to consolidate and redevelop the precinct since the 1960s, but discouraged by the opposition of the National Trust and the Historic Buildings Council, the insurance company decided to abandon plans of redevelopment and sell.²⁰

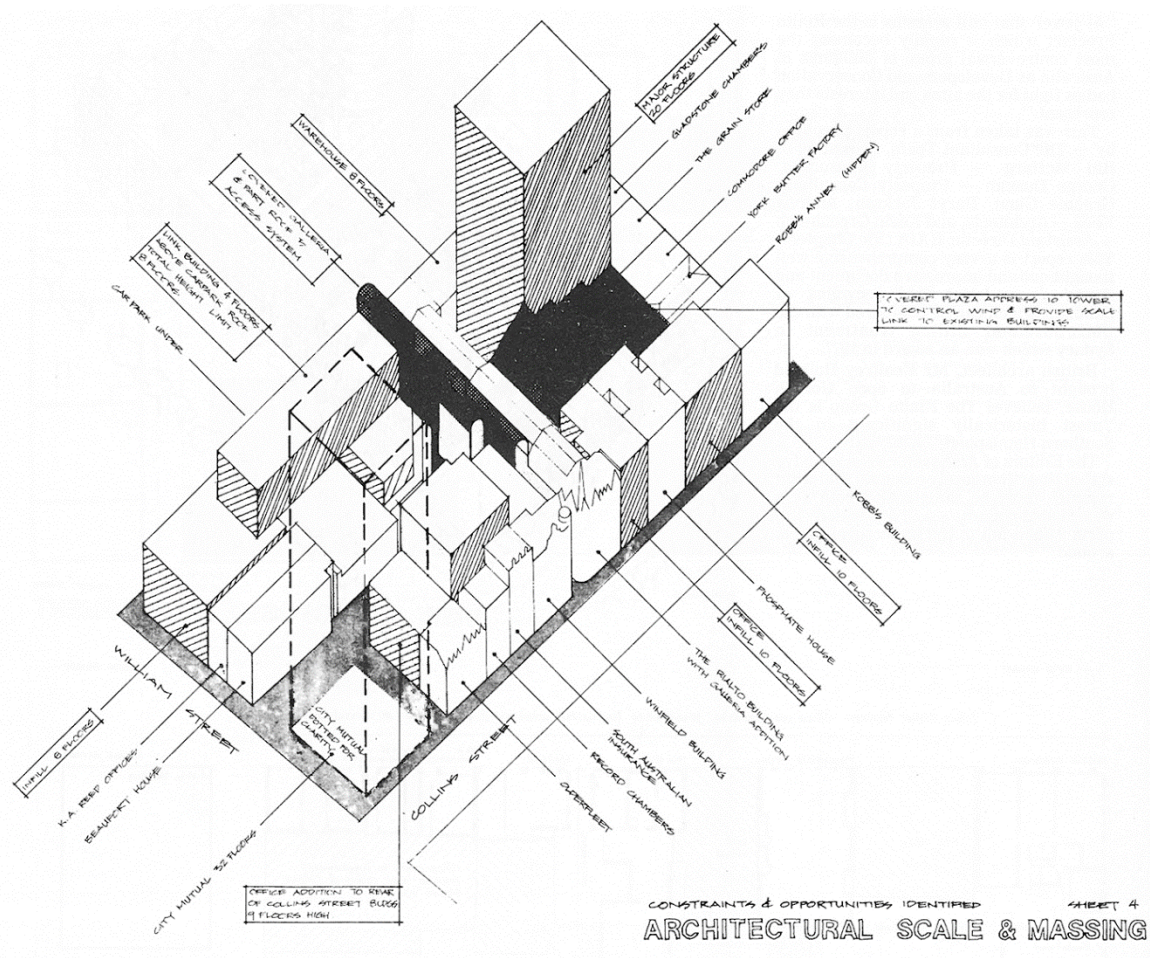


Figure 5.3
Rialto Precinct Masterplan, 1979

In the late 1970s, a masterplan for the redevelopment of the Rialto Precinct was commissioned to a collaborative of property consultants, planners and architects,²¹ which envisaged an operation of restitching in the precinct of existing historical buildings with

²⁰ Dunstan "Why I love Melbourne's Ayers Rock," 24.

²¹ The team of consultants was formed by Bill McHarg, George Duncan, Graeme Gunn, Daryl Jackson, Andrew Reed and Kevin Greenhatch.

conditional to the preservation of three key historical buildings of the precinct and carrying out of wind tests to ascertain pedestrian comfort at street level.²⁴

The new plan for Rialto sparked much debate and controversy, when workers of the trade union Builders Labourers Federation (BLF) refused to carry out demolition works at the Robb's Building. The project was heavily criticised because one of the three towers overshadowed the others, and most of all, for the intrusive relationship with the York Butter Factory, an older historical building on King Street. In *The Age*, Norman Day vehemently opposed the development depicting it as a "rape".²⁵

Objections arose from the National Trust and the Collins Street Defence Movement for the demolition of several historical buildings in the precinct and the modality of alteration of those to be preserved. The objectors contested "the philosophy of Hollywood sets" to preserve historical façades in front of multi-storey buildings, and criticised the decision as of "shockingly low standard for Collins Street."²⁶ More controversy followed and exploded internally at the National Trust. Negotiations of the Trust with the City of Melbourne were established in order to find a "deal" to save and restore the key historic buildings in the precinct. But the agreement sparked dissent among the more orthodox conservationists and caused four members of the Trust to resign.²⁷

Rialto: two towers [Map 5D, 64]

The Chief Commissioner of the City of Melbourne,²⁸ Peter Thorley, defended the proposal to develop Rialto with high-rise buildings as a necessary matter of economic development and for the need to preserve the key historic buildings on site. In an article in *The Age*, the temporary head of the City defended the decision taken by interim authorities stating that "otherwise tax payers would have to subsidise the development."²⁹ The financial rationale of the project was based on an explicit private-public agreement. Grollo, in joint venture with Kuwaiti-based St Martins Properties, would undertake the restoration of three existing

²⁴ PROV, City of Melbourne, VPRS 8945/P2, unit 217, Building and Land Use Committee, Application n. C.M. 4645, City of Melbourne Report, 1 October 1981.

²⁵ Norman Day, "Collins St: another case of rape," *The Age*, November 6, 1981, 11.

²⁶ PROV, City of Melbourne, VPRS 8945/P2, unit 217, Building and Land Use Committee, Application n. C.M. 4545: Objections to Grant of Permit [1981].

²⁷ "Four quit Trust over Rialto deal," *The Age*, December 18, 1981, 3.

²⁸ Between May 1981 and September 1982, the City of Melbourne was temporarily governed by a panel of commissioners.

²⁹ Michele Nayman, "Council set to approve Rialto Plans," *The Age*, October 9, 1981, 16.

historical buildings; in return the government committed to rent 250,000 square feet of office space in the high-rise buildings proposed.

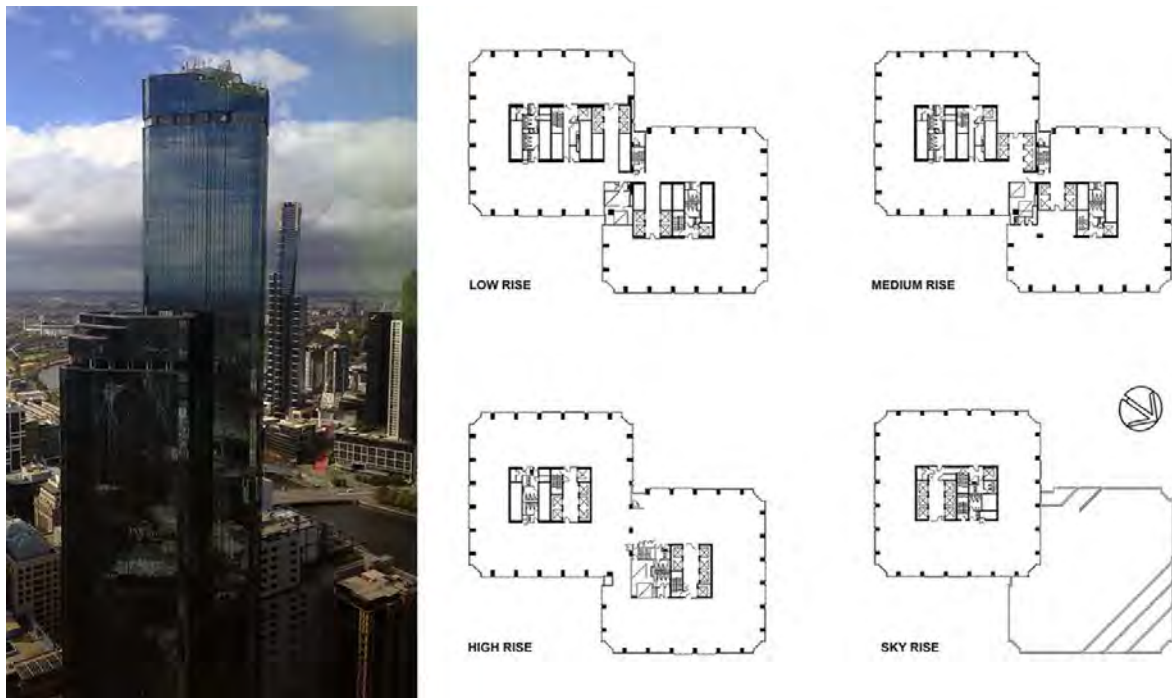
In 1982, the initial scheme was amended. Following controversy about the York Butter Building, which in the original scheme was to be penetrated by pylons to support part of the new development overhead, one of the three towers was eliminated from the scheme. The subsequent solution envisaged by De Preu was simple and yet radical. In order to keep the same development area, the office block that originally sat over the York Butter Factory was transplanted over one of the other two towers. The result was two towers of different height engaged: an asymmetrical skyscraper with two merging shafts of 56 and 38 storeys.³⁰

The plan was 8-shaped and formed by the cellular aggregation of two squares with central core. Geometry and dimensions of this solution were similar to Collins Tower at Collins Place. By and large, the concept was also similar to 200 Queen Street, and to Transport House [Map5C, 3], a smaller office building designed by Perrott Lyon Mathieson Architects (PLM), who were co-responsible with De Preu as the executive architects of Rialto.³¹

Overall, the typical floor plan had 1,800 square metres of net lettable area, while at the top only one half of the base continued to soar generating approximately 1,000 square metre of office space on each floor. The building was punctuated by a perimeter column frame at 5.5 metre centres and floors had all-round open space spanning 11 metres from the façade to the core. The corners were slightly cut off, giving opportunities for interior designers to include up to 12 corner rooms on each floor. Overall, the double centre core served almost 85,000 square metres spread in 56 floors of office accommodation that were reached by 35 lifts divided in four lift groups: low-rise, medium-rise, high-rise and sky-rise - a configuration anticipated and used for the first time in Melbourne in the tower of the State Bank Centre.

³⁰ Dunstan, "Why I love Melbourne's Ayers Rock," 23.

³¹ "589 Collins Street," *Constructional Review* 57, no. 3 (August 1984): 21-26, 54-55.

**Figure 5.5**

Rialto Towers, 501-535 Collins Street, 1982-86

Ayers Rock and the bull market

Rialto and 200 Queen Street had several things in common: same architect and structural engineer, same owner, developer and builder and similar building systems and materials. Both towers were all-concrete structures almost entirely clad in reflective glass. The latter was a new product that, due to higher reduction of heat-gain, found widespread application in office buildings as a replacement of heat-absorbing glass.³²

In the late 1970s, in response to the energy crisis of the 1970s, reflective glass reached Australia and in the 1980s, concerns grew among town planners about some potential negative effects of the new material. These concerns reached Melbourne City Council, which then commissioned a report to determine an acceptable level of visible light reflectance from glass façades.³³ After surveying the major office buildings of the CBD, the City of Melbourne found that reflective glass with up to 40 percent reflectivity was

³² Giorgio Marfella, "From heat absorption to speculation: the troubled evolution of all-glass architecture in Melbourne, 1955-1982," in Annmarie Brennan and Philip Goad [eds.], "Gold," proceedings of the 33rd conference of the Society of Architectural Historians, Australia and New Zealand, Melbourne 6-9 July 2016, 404-417.

³³ PROV, City of Melbourne, VPRS 8945/P2, unit 221, Building and Land Use Committee, memorandum, subject: "Reflective Glass," 7 August 1984.

already used in several high-rise office towers. In 1984, following a trend initiated by other Australian cities, the Council developed a non-prescriptive guideline that established a maximum level of reflectivity for new buildings. While some scientists downplayed concerns about reflectivity, which was thought to cause hazards to motorists and adjoining properties, some controversy followed when the tenants of the State Insurance Office, a property on Collins Street opposite the Rialto, complained, as reported by the *The Age*, for the “blinding glare” received by the newly completed towers.³⁴

Notwithstanding controversies, which accompanied Rialto since its conception,³⁵ the towers marked a turning point of construction activity in the city. Topping at 243 metre high, Rialto was not simply the tallest office building in the city; it was the tallest in Australia and one of the tallest concrete structures of the world, only second - at that time - to the 262 metre-tall Water Tower Place in Chicago. Rialto, once completed, gained an unexpected iconic appeal as testified for example by the comments made by journalist Keith Dunstan. Dunstan was caught in awe by the ever-changing surfaces of reflective glass and defined Rialto as “Melbourne’s Ayers Rock”.³⁶ According to *Architecture Australia*, the sparkling all-glass curtain wall of Rialto – supplied locally by ACI-Pilkington,³⁷ was a new “landmark” for the city, which married “history with the future”.³⁸ The new scheme was after all a compromise between private and public interests. It was not accepted by everybody as a success, but part of public opinion of the time, as it was put by an editorial of *The Age*, endorsed the project as an outcome that was ultimately “better than most of the alternatives being canvassed”.³⁹

222 Exhibition Street [Map 4D, 65]

A third tall office project conceived in the first half of the 1980s was built at 222 Exhibition Street, a parcel of land of 5,500 square metres, in the north-eastern sector of the CBD, at the corner of Exhibition and Little Bourke Streets. The property, originally owned and occupied by Lane Motors Holdings, was purchased in 1984 for \$10,000,000 and it was subsequently developed by the Australian-Japanese joint venture of Carringbush and

³⁴ Jenn Conley, “Rialto glare: Grollo may be asked to pay,” *The Age*, November 18, 1985, 3.

³⁵ Pamela Pinto, “Developers admit corruption charges,” *The Age*, February 24, 1983; Kate Ledge and Brendan Donohoe, “Grollo bows to industry code,” *The Age*, December 19, 1985.

³⁶ Dunstan, “Why I love Melbourne’s Ayers Rock.”

³⁷ “Glass makes Rialto sparkle.” *Building Product News: Rialto Feature*, (August 1985): 22, 24.

³⁸ “Rialto: a Landmark for Melbourne.” *Architecture Australia* 77, no. 7 (July 1988): 56-61.

³⁹ “Rialto: a case of compromise,” *The Age*, November 27, 1981, 13.

Kumagai Gumi. In January 1988, the land - with the building still under construction - was sold by the Nippon-Australian developer for \$138,000,000.⁴⁰

In early 1984, a planning application for the site was submitted for a twenty-six storey office building over a podium of retail and car parking and a small low-rise residential row of townhouses. The project was presented to the City of Melbourne, by architect Bill Corker of Denton Corker Marshall. The design of the tower was characterised by a compositional device used to reduce the bulky proportions of the centre-core square tower:

The tower is proposed to house office accommodation of moderate rental. It is not anticipated that a prestige office block would be viable in this location. The dictates of the market are that office accommodation be on a square plan approximately 40 metres x 40 metres: this requires a building form that is somewhat 'dumpy'. In order to offset this 'dumpiness', the architects have divided the faces of the tower by a slot. It is envisaged that the tower would be clad in banded glass, probably of pink and pale turquoise.⁴¹

Differences of opinion arose in the planning assessment of the project about the location of the tower, which the architects had aligned on Exhibition Street to keep a "lower scale" on the inner side of the development, where the small residential annex was located along a laneway. This design proposal was ultimately approved, but it was opposed by the City of Melbourne on grounds that "more was to be gained than lost by moving the tower" away from the street as much as possible from the main frontage of Exhibition Street.⁴²

The project was covered, like 200 Queen Street and Rialto, by a curtain wall of reflective blue glass. Completed in the late 1980s, 222 Exhibition Street was a finalist of the RAIA Corporate and Office Design Award. RAIA juror Peter McIntyre acknowledged the ability of the architects to slim down "the stumpy proportions" of an otherwise normally speculative square tower with vertical re-entrants embellished by steel balconies. McIntyre praised DCM's project, as a counterpoint to the usually "not good architecture" of inner city commercial developments⁴³ and as one of the first tall office building conceived in response to an entirely new set of planning and urban design controls.

⁴⁰ Cityscope, map 25, property 2A.

⁴¹ PROV, City of Melbourne, VPRS 8945/P2, unit 223, Building and Land Use Committee, Application n. DP 84/0309, 5 November 1984.

⁴² PROV, DP 84/0309, 5 November 1984.

⁴³ Peter McIntyre, "222 Exhibition Street, Denton Corker Marshall: Finalist Australian Design Series Corporate and Office Design Award," *Architecture Australia* 78, no. 12 (December 1989): 49.

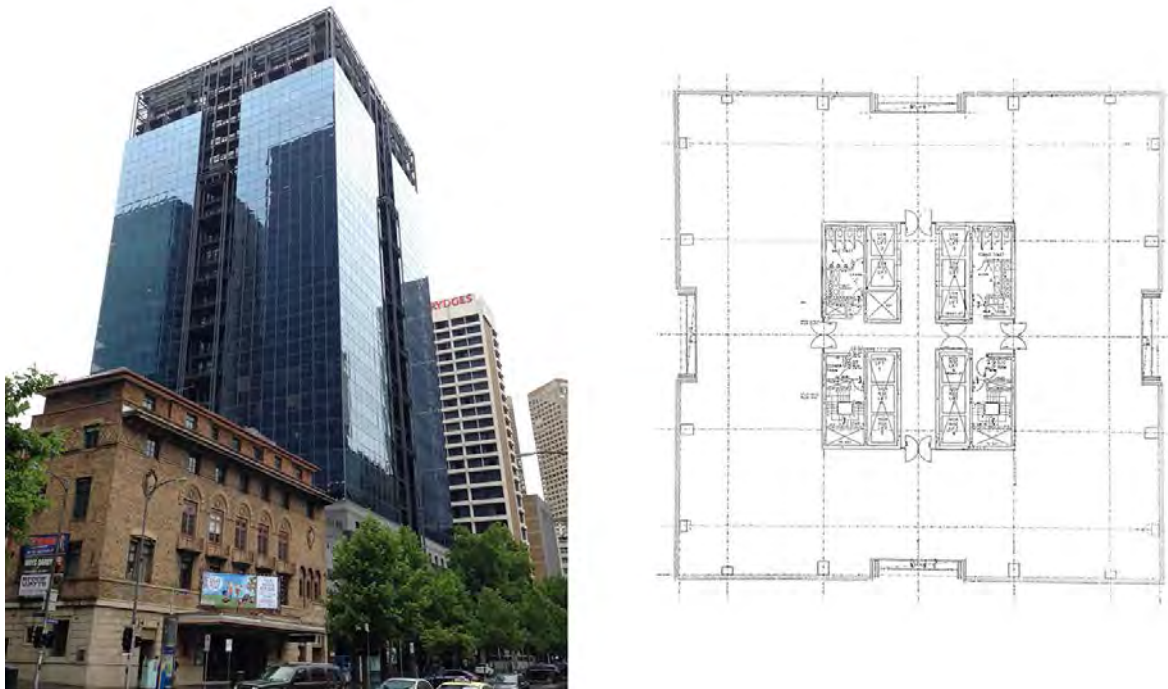


Figure 5.6

222 Exhibition Street, 196-226 Exhibition Street, 1985-88; external view and low rise plan

Rialto and the other reflective glass towers of the first half of the 1980s fuelled the city with a “glowing optimism” that spread among developers, architects and planners. A strong entrepreneurial sentiment of confidence arose in the mid-1980s, while the city embarked on a mission of rejuvenation through new design controls and building assessment practice. In the second half of the 1980s, business opportunities for architects increased, and hopes that construction activity driven by the “bull market” would bring innovation through a new generation of buildings were high.⁴⁴

5.2 From City to State, from plaza to podium

Transitions in built-form control

The Collins Street Defence Movement

From the early 1970s onwards, a cultural shift emerged in Australian architecture and urban design. At first, the shift took form in civic, cultural and intellectual protests against

⁴⁴ “Bull market to promote innovation: architect,” *The Age*, September 9, 1987, 27.

tall building developments and channelled political activity through the rise of conservation movements.

In 1976, a group of urban activists, planners, and architects formed the Collins Street Defence Movement, an association with the purpose to contrast modern commercial developments in the most prestigious and monumental street of the city.⁴⁵ The Collins Street Defence Movement was instrumental in driving the National Trust of Victoria, the chief authority on historical preservation, towards the preparation of the *Collins Street Report*, a study prepared with the objective “to maintain the character of Collins Street as derived from compatible economic, social, and architectural values.”⁴⁶ The report stemmed from a political view that wished to recover architectural quality from past aesthetic themes of the Street, and which saw high rise developments –as they had been conceived until then in Melbourne - as a negative form of urban transformation:

These new towering structures are of such height, bulk, scale and character as to dominate much of the street (and adjacent streets and areas) and create conditions and influences out of harmony with the remainder of the street. Moreover, the bulk and dominating character of many of these new buildings has had a dehumanizing influence on substantial parts of Collins Street’s environment. Many places in the street are now wholly out of human scale.

The *Collins Street Report*, was influenced by other urban conservation movements from overseas, chiefly one in San Francisco, which contemplated a radical proposal to impose an “iron-clad city-wide” building height limit in the Californian city.⁴⁷ Inspiration taken from San Francisco was acknowledged by the Collins Street Movement, and it was reflected by the proposal to introduce in Collins Street, among other controls, a building height limit of 40 metre - the metric equivalent of the old limit of 132 feet.⁴⁸

A moderate compromise emerged, however, from the official conclusions of the Report. Ultimately, the National Trust did not concede that opportunities for high-rise developments should be eliminated altogether in Melbourne’s CBD, nor in Collins Street. On the one hand, the Report aimed to ensure the preservation of the streetscape’s “character” by preserving only the main façades of buildings of historical significance. On

⁴⁵ Miles Lewis, *Melbourne: the City’s History and Development* (Melbourne: City of Melbourne, 1995), 139.

⁴⁶ National Trust of Australia (Victoria). *Collins Street Report: a report by the Urban Conservation Committee of the National Trust of Australia (Victoria) on suggested planning policies and guidelines for Collins Street* (Melbourne: National Trust of Australia, 1978).

⁴⁷ National Trust of Australia, *Collins Street Report*, 75-78.

⁴⁸ National Trust of Australia, *Collins Street Report*, 42.

the other hand, it was proposed to implement planning and urban design controls acknowledging that development needs should be satisfied to “make buildings more habitable and more economical to run.”⁴⁹

The city profile

In the early 1980s, a structural change of governance affected the City of Melbourne and provided the opportunity, as advocated by the Collins Street Report, to reconsider built-form controls in the CBD. In 1982, decision-making powers for metropolitan planning and large city development approvals were transferred from the local government of the City to the State of Victoria, under the competence of the State Minister for Planning.⁵⁰ Soon after this shift of power, in November 1982, the office of the Planning Minister of the time, architect Evan Walker, released a new Interim Development Order (IDO) for the inner city.⁵¹

The 1982 IDO was conceived to execute the vision and motivations of the 1974 Strategy Plan, and it was announced as the lead-up towards a new season of urban politics in contrast with a past of “bad planning” and a “long history of inaction”.⁵² The IDO contained guidelines for the inner city in three key points: the creation of an overall city profile and appearance, a new map of destination of use within the city, and new measures of traffic control. Among its goals, the IDO planned to revitalise and stimulate the city with new developments, to create a more pleasant environment for people to live and work in, and at the same time, to protect the historical heritage of the inner city.⁵³

Despite a declared antagonism against previous planning practice, the 1982 IDO contained elements of continuity with the 1964 Melbourne Planning Scheme. After the introduction of plot ratio controls, the 1964 Scheme created clusters of high-rise density in determined areas and along certain axes of development in the CBD. The overall form of the city’s

⁴⁹ National Trust of Australia, *Collins Street Report*, 37.

⁵⁰ PROV, City of Melbourne, VPRS 8945/P2, unit 218, Building and Land Use Committee, Letter of the Minister for Planning Victoria to the City of Melbourne, 7 July 1983; City of Melbourne, memorandum of the Building and Land Use Committee, subject: “Delegation of Powers – City of Melbourne Central City Interim Development Order 1982,” 2 August 1983.

⁵¹ Victorian Department of Planning, *Planning Our City: City of Melbourne (Central City) Interim Development Order, 1982* (Melbourne: Victorian Department of Planning, 1982).

⁵² Victorian Department of Planning, *Planning Our City*, 2.

⁵³ Victorian Department of Planning, *Planning Our City*, 2.

skyline was already pre-envisaged in 1964, alongside the low-rise heritage character of the central part of the grid.

In the 1980s, the instrument of zoning by plot ratio reached a larger scale of influence, when the vision of a skyline with a central “view corridor” was thereon implemented physically with more awareness. Planning Minister Evan Walker was instrumental as the promoter of this vision, as he followed aspirations he acquired as a young architect, to emulate in Australia the beauty of the skyline of Tuscan town of San Gimignano.⁵⁴

The profile of the city envisioned by the 1982 IDO was structured to create a specific profile with a “low centre” and “high edges”. The inner part of the city grid, the “heart” along Swanston Street, was planned as a low rise pedestrian retail and entertainment environment, which was protected under a “blanket” height control of 40 metres. High-rise office buildings were to be developed “at the edges” of the Hoddle grid. This goal was complemented by the idea of protecting monumental buildings and views “in and out of the city” and – consequently - to and from high-rise buildings themselves. The new plan aimed to stimulate development also along new axis on the northern area of the CBD, chiefly along and nearby the western end of La Trobe Street and the eastern end of Lonsdale Street.⁵⁵

Reinstating the streetscape

Walker’s vision for a designed city profile percolated from the scale of the city to that of single buildings. The new policy contained a comprehensive range of urban design controls conceived to influence also “how the city will look like”.⁵⁶ The 1982 IDO was the preamble of a more definitive planning instrument, and three years later the new rules were consolidated and adopted by the City of Melbourne as the *1985 Strategy Plan*.⁵⁷

During the 1980s, developments in the CBD continued to be controlled by plot ratio at a precinct level. A base plot ratio of 6 was applicable in the central city and could be increased in some areas by bonuses “at the discretion of the Minister” in return for open space, retention of historical facades, ground level setbacks, arcades, weather protection,

⁵⁴ Daryl Jackson, interview, Melbourne, 11 September 2014.

⁵⁵ Victorian Department of Planning, *Planning Our City*, 3.

⁵⁶ Victorian Department of Planning, *Planning Our City*, 2.

⁵⁷ City of Melbourne, *City of Melbourne Strategy Plan 1985* (Melbourne: Strategic Plan Division, 1985).

cut-off corners and, ultimately and more generally, “to enable planning authorities to influence the nature of the development.” Plot ratios, however, were recognised by planners as necessary but insufficient controls, as they could not influence effectively the “built form” of developments.⁵⁸

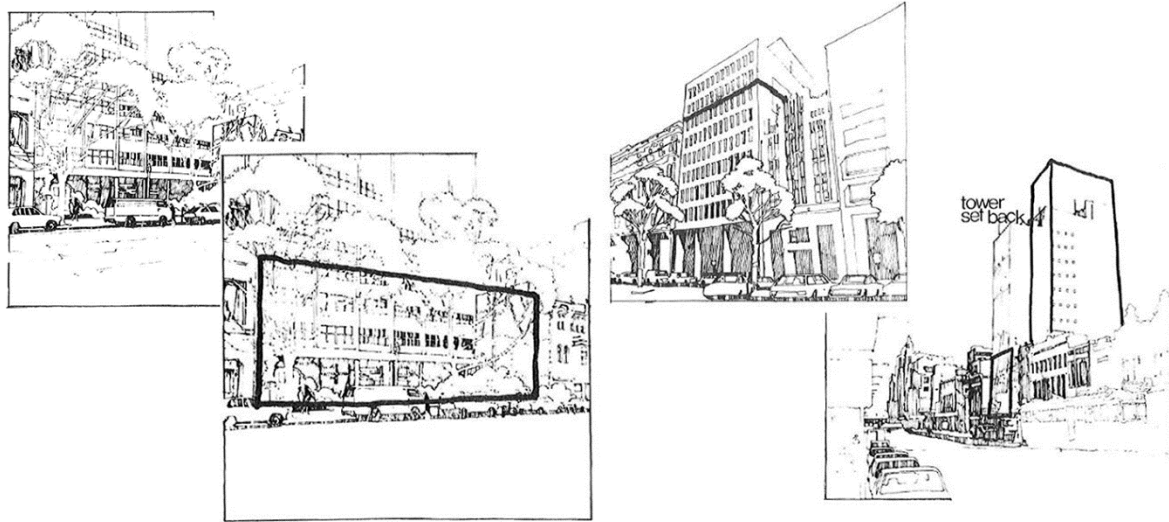


Figure 5.7
City of Melbourne, streetscape design guidelines, 1982

The Strategy Plan controlled in fact, with far more prescription than in the past, the form of buildings with the “Built Form Envelope Controls”; firstly, by imposing a building height blanket of 40 metres for most of central area; secondly, by requiring to “build up to street frontages”. Along the main streets, new building parapets were expected to align at 30 metres height and to maintain a ratio of one to one between width and height of the street. Tall buildings were to sit over a notional podium of 30 metre height and step back progressively from the street boundary by 10 metre for every 30 metres of building height.⁵⁹

These controls were illustrated by a set of design guidelines prepared in support of the 1982 *Interim Development Order* by the Victorian Department of Planning.⁶⁰ The guidelines specified site coverage and spacing among adjacent buildings, and set a

⁵⁸ City of Melbourne, *City of Melbourne Strategy Plan 1985*, 120.

⁵⁹ City of Melbourne, *City of Melbourne Strategy Plan 1985*, 125.

⁶⁰ Victorian Department of Planning, *Melbourne Central City Development Manual* (Melbourne: Victorian Department of Planning, 1982), Part C: “Interim Central City Planning and Design Guidelines.”

minimum distance of 20 metres between neighbouring towers in order to preserve views.⁶¹ Continuity between old and new was encouraged. Buildings along main streets were expected to follow consistently dominant parapet lines, creating “visual relationships” by stepping parapets and setting back progressively the envelope of tall buildings.

The design guidelines extended to the control of façade detailing, targeting the lack of consistency of post-World War II buildings, and aiming to prevent a “mix of styles”. Continuation of fenestration patterns and consistent relationships of scale with adjoining historical buildings were desirable, especially on major streets and at ground level. Indications on façade detailing were also given, suggesting to “repeat” cornices, and mouldings, and recommending that new buildings should mimic colours and materials of their pre-modernist historical surroundings.⁶²

Control of the built form was complemented by a new philosophy about urban voids and open space. The IDO design guidelines were eloquently illustrated by hand-drawn sketches. The forecourts of BHP House in William Street and of CRA in Collins Street were shown as past specimens of negative design practice guilty of “interrupting” the streetscape and forsaking the creation of “recreational space”. The new guidelines advocated instead better orientation, landscaping, use of street furniture, wind protection, and more exposure to the sun.⁶³

Consideration for open space went beyond the inner city realm of streets and plazas. A new urban design control prescribed to prevent casting of shadows over parks and on the northern bank of Yarra River during the winter solstice, between 11am and 2pm of the 22nd June.⁶⁴

⁶¹ Victorian Department of Planning, *Melbourne Central City Development Manual*, 85-94.

⁶² Victorian Department of Planning, 96-99.

⁶³ Victorian Department of Planning, 53.

⁶⁴ Victorian Department of Planning, 51.

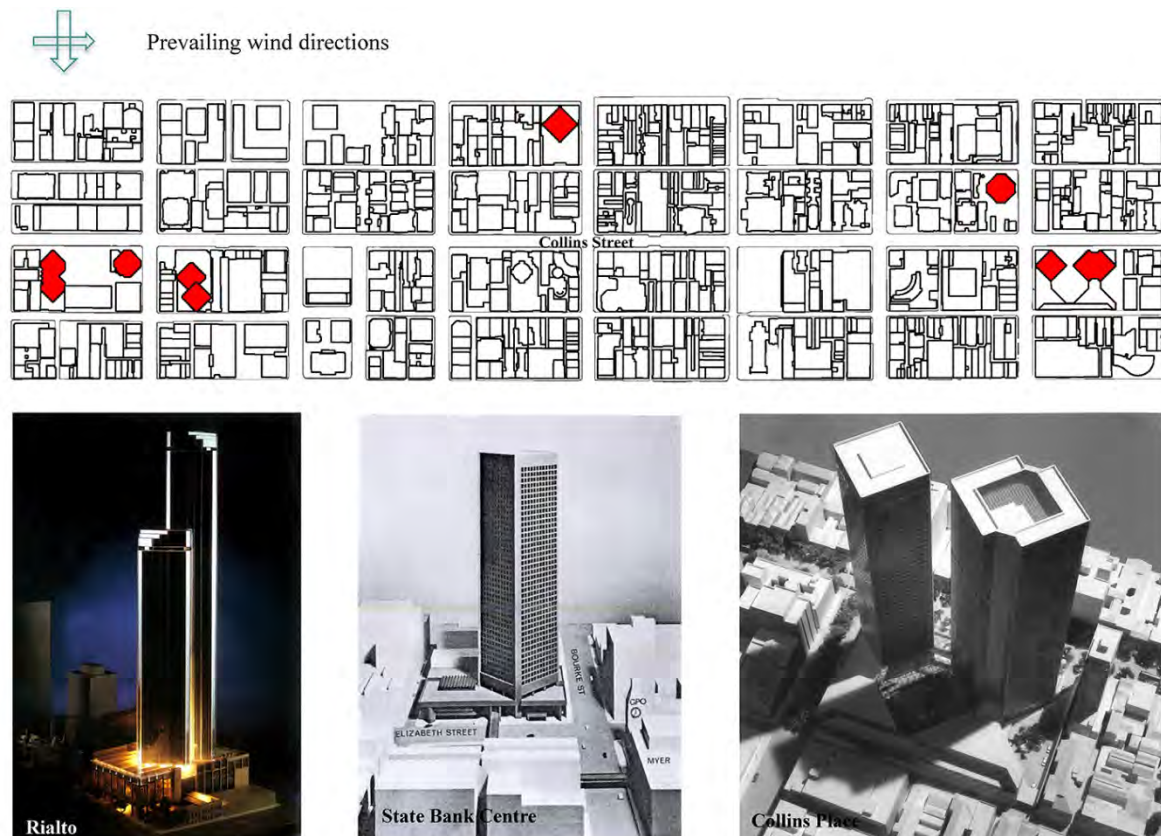


Figure 5.8

Collins Street, Melbourne; towers rotated at 45 degrees from street to minimise impact of prevailing winds

Winds of change

New measures affecting public open space included instructions to prevent adverse wind effects on plazas, parks and gardens. Criteria were set for a maximum “gust speed caused by the building up to a height of 3 metres above ground.” The 1982 IDO made a requirement that development proposals should carry out wind tunnel tests and produce evidence that wind criteria for environmental comfort at street level were met.⁶⁵

In Melbourne, awareness of the effects of wind to the environment surrounding tall buildings had been anticipated, at least a decade earlier, by a growing knowledge in the field of wind engineering. From the mid-1960s onwards, a professional and scientific community of wind engineers grew in Australia. In Victoria, local wind engineering pioneers built up new knowledge in parallel with the North-American counterparts in the

⁶⁵ Victorian Department of Planning, *Melbourne Central City Development Manual*, 51.

field, such as Alan Davenport and Leslie Robertson.⁶⁶ While American engineers developed the discipline from a structural engineering point of view, Australian progress developed independently - and *pari passu* from an aerodynamic perspective. Some of the first results of knowledge in this new field went into the study of environmental conditions at the ground level of tall buildings.

In Melbourne, in the inner city and outside, during the 1950s and the 1960s, considerable problems of wind comfort were experienced by pedestrians walking at street level under some tall buildings. The forecourt of the CRA Building in Collins Street, for example, was affected by considerable wind problems. ICIANZ House and AMP Square also created similar problems and caused situations of discomfort to passers-by.⁶⁷ The corner forecourt of the MLC Building, at the intersection of Collins and Elizabeth Streets, was also known to be affected by pedestrian discomfort.⁶⁸

In the late 1960s, after measuring the speed of wind gusts in several urban environments, William Melbourne, a local expert in fluid mechanics with an aeronautical engineering background, completed an experimental study that allowed quantifying the entity of these problems. The study considered four tall buildings as case studies - the CRA Building, the ICIANZ House, the Menzies Building at the Monash University, and the Raymond Priestley Building at the University of Melbourne - and led to the determination of acceptable wind gust velocity in relation to the destination of use of a public open space. These results were the first steps of what still stands today as an internationally recognised criteria for establishing environmental wind conditions in urban environments.⁶⁹

The outcome of this study was soon applied to major tall building developments in the city, such as Collins Place and the State Bank Centre. From the early 1970s, wind tunnel assessments demonstrated that, given Melbourne's prevailing north-westerly winds, a rotation of 45 degrees to the alignment of the grid, combined with street setbacks and

⁶⁶ "Tall and Taller Towers," in Siobhan Roberts, *Wind Wizard: Alan G. Davenport and the Art of Wind Engineering* (Princeton, NY – Oxford, UK: Princeton University Press, 2013), Chapter 2.

⁶⁷ William H. Melbourne, interview, South Oakleigh (Victoria), 24 February 2015.

⁶⁸ PROV, City of Melbourne, VPRS8945/P2, unit 224, Building and Land Use Committee, Application no. DP 85/0142, 1985.

⁶⁹ William H. Melbourne, *Ground Level Wind Conditions Caused by Large Buildings* (Clayton, VIC: Monash University Department of Mechanical Engineering, 1971), paper first published at the 43rd ANZAAS Conference, Brisbane 1971.

ground separation by means of a podium, could significantly help to achieve acceptable environmental conditions on footpaths.

In the 1980s, the criteria developed by William Melbourne prompted the introduction of urban design performance expectations for wind gusts and to the standard *praxis* to seek early input from wind engineers on tall building projects. At Rialto, for example, the wind assessment of the initial scheme revealed the need to revisit drastically the initial concept. In response to an early wind analysis, the project was amended with a rotation of the tower at 45 degrees from the street alignment, the creation of a podium and the relocation of the taller of two towers at the rear of the site.⁷⁰

Deregulation

Changes in planning policy, governance and urban design control in Victoria were accompanied by the replacement of the Uniform Building Regulations with a new building code, the Victorian Building Regulations (VBR). The VBR aimed to deregulate the construction industry and initiate a progressive departure from the largely prescriptive approach of the UBR, leading to the novel concept of performance-based design. The VBR explicitly aimed to allow designers and builders to innovate by considering alternative solutions that could meet set performance parameters. Another self-declared purpose of this regulatory transition was to alleviate an enduring trend of building applications subject to and pending request of *ad-hoc* modifications of the UBR to the Board of Building Referees.⁷¹

The VBR, however, were intended as a transitional stage without precluding traditional prescriptive measures. One of these transitional measures affected, for example, the provisions of egress for fire-safety. A new step by step approach was introduced for the determination of the number and width of exits and for the maximum distances of travel needed to evacuate a building. The new provisions amended the older UBR criteria based on the 'diagonal' or 'arc distance' to an exit that was irrespective of partitioning and furniture layouts and that prescribed 30 metres for buildings without sprinklers and 45 metres for buildings equipped with sprinklers.

⁷⁰ Melbourne, interview, 24 February 2015.

⁷¹ State of Victoria, Local Government Department, *VBR Study Bulletin*, no. 2, (November 1983).

The VBR allowed the travel distance to be worked out in two stages; first by measuring the “actual distance” – maximum 15 metres for commercial buildings - to a “point where egress in different directions not less than 90 degrees to two exits is available.” The second leg of the travel was then prescribed as a maximum “actual” distance, which for office buildings could not exceed 40 metres.⁷² In the final version of the VBR, the distance of the first leg of travel to a “point of choice” for two directions of escape was increased from 15 metres to 18 metres. This further amendment reinforced the range of opportunities given to designers for commercial spaces characterised by larger floor plates and a deeper distance from the façade to the service core.⁷³

In the second half of the 1984, a step of deregulation was taken further once Melbourne City Council launched the Development Approvals Task Force (DATF), a unit of inquiry formed by City Councillors, architects, engineers and a representative of BOMA. The Task Force was engaged to determine ways of reducing delays in approvals for planning and building permits, and to eliminate wherever possible “red tape” and to increase efficiency in the feedback to building applications.⁷⁴

In May 1985, the DATF made a series of interim recommendations that, among others, included a modification of the Building Control Act 1981 and the establishment of a procedure of certification open to independent checkers. The latter were certifying authorities that could be delegated to operate as an alternative to the Building Surveyor of the City of Melbourne. The purpose of this last proposal was made “in view of the need of expeditious granting of building approvals”.⁷⁵ At the time of its introduction, private building surveying was seen as a necessity for coping with the high levels of development activity in the city.

The Aesthetics Advisory Panel

Changes in the regulatory environment were complemented by new procedures and trends of assessment of architectural design. In the late 1970s, awareness grew among planning

⁷² State of Victoria, Local Government Department, *VBR Study Bulletin*, no. 8, (November 1983).

⁷³ State of Victoria, Local Government Department, *Victorian Building Regulations* (Melbourne: Victorian Government Print Office), 1984-1995.

⁷⁴ PROV, City of Melbourne, VPRS 8945/P2, unit 223, Building and Land Use Committee, Melbourne City Council, Development Approvals Task Force, newsletter no. 1, December 1984.

⁷⁵ PROV, City of Melbourne, VPRS 8945/P2, unit 225, Building and Land Use Committee, Melbourne City Council, Development Approvals Task Force, newsletter no. 2, May 1985.

authorities about the importance of aesthetics in major building proposals. A cultural shift was acknowledged by the City of Melbourne and, as an outcome of the first Strategy Plan, the City established the Aesthetics Advisory Panel (AAP), a forum of peer review, discussion and advice on development applications at the City of Melbourne.

The AAP was formed in 1978, following “considerable philosophical debate” and controversy on the merit of its purpose.⁷⁶ It was initially composed by representatives of the architectural profession and arts, namely Barry Patten of Yuncken Freeman and Roy Grounds of Roy Grounds & Partners, and two art critics and curators of the National Gallery of Victoria, Patrick McCaughey and Eric Westbrook. The Panel was later expanded to include a fifth member, architect Robert Bruce of Bates, Smart & McCutcheon. From 1985, the AAP was expanded to 8 members and its base broadened to include representatives of the disciplines of landscape architecture, urban design, and building conservation.⁷⁷

The functions and procedures of the panel consisted in meeting upon request of the City of Melbourne Council, to hear and discuss presentations of representatives of the applicants and give advice to planning authorities on aesthetic matters related to development proposals. Opinions and comments of the panel were relayed to the Building and Land Use Committee of the City of Melbourne, to the Melbourne City Council, and after 1982 also to the Planning Minister of the State of Victoria. From the mid-1980s onwards, the work of the AAP provided systematic advice on most major projects in the inner city.

The Aesthetics Advisory Panel was part of several planning bodies, which, in the 1980s were appointed to comment and recommend upon building applications at the Victorian Department of Planning, such as the Heritage Unit and the Urban Design Unit of the State of Victoria. The Minister would receive also advice – independently, but with a

⁷⁶ PROV, City of Melbourne, VPRS 8945/P2, unit 224, Building and Land Use Committee, memorandum, subject: Aesthetics Advisory Panel, 21 March 1985.

⁷⁷ After the establishment of the AAP, the position of Roy Grounds was taken by his colleague Fritz Suendermann. Additional members indicated by the City of Melbourne included: Conrad Hamann (Senior Tutor, Department of Visual Arts, Monash University), Margaret Manion (Professor of Fine Arts, University of Melbourne), Howard McCorkell (landscape architect, Tract Consultants), Nigel Lewis (architect, Nigel Lewis Architects), David Faggetter (architect, Gerner Sanderson, Faggetter and Cheesman), George Seddon (Dean, Faculty of Architecture, Building and Planning, University of Melbourne), Peter Corrigan (architect, Edmond and Corrigan) and Richard Petersen (architect, Urban Spaces). PROV, M.R. Williams, memorandum, subject: Aesthetics Advisory Panel, 11 April 1985.

considerable overlap of functions with the aesthetic advisors - from the Urban Design Unit of the City of Melbourne, which kept the role to assess *in primis* building applications, provide comments, make suggestions and formulate a final recommendation to the Minister.⁷⁸



Figure 5.9

The “Big Six”: (from left to right) 101 Collins, 120 Collins, 333 Collins, 530 Collins, Bourke Place and Melbourne Central

5.3 The bull market (stage 2)

The “Big Six”

120 Collins [Map 8A, 69]

In the context of these regulatory changes, a new generation of tall office buildings was conceived, designed and built from the second half of the 1980s to the early 1990s. Among the high number of speculative office buildings completed at that time, six large ones were built almost at exactly the same time. These projects stood out for size, height and built-form and left an enduring visual presence on the skyline of the city, and were testimony of the final rush of the ‘bull market’. Almost all of the projects were developed in Collins Street, along the eastern and western ends of the street.

In 1982, land was consolidated at the north-eastern corner of Collins and Russell Streets, merging properties at 108-120 Collins Street, which included the historical Professional Chambers Building, 96-112 Russell Street and 129-161 Little Collins Street. The three parcels formed an L-shaped site surrounding the Romanesque Revival building of the Independent Church (1866-67). The site was traded in 1982 for \$5,000,000.⁷⁹ In 1983, a proposal of development was submitted by the land owner, Civil and Civic of Lend Lease,

⁷⁸ PROV, M.R. Williams, memorandum, subject: Aesthetics Advisory Panel, 11 April 1985.

⁷⁹ Cityscope, map 32, property 24.

for a 38 storey-high rectangular office building designed by Meldrum Burrows & Partners. Civil and Civic's proposal conformed to the principles of development set by a study prepared by the Department of Planning of the State of Victoria, which identified the area as suitable for a high-rise structure on the north-east corner of the site.⁸⁰

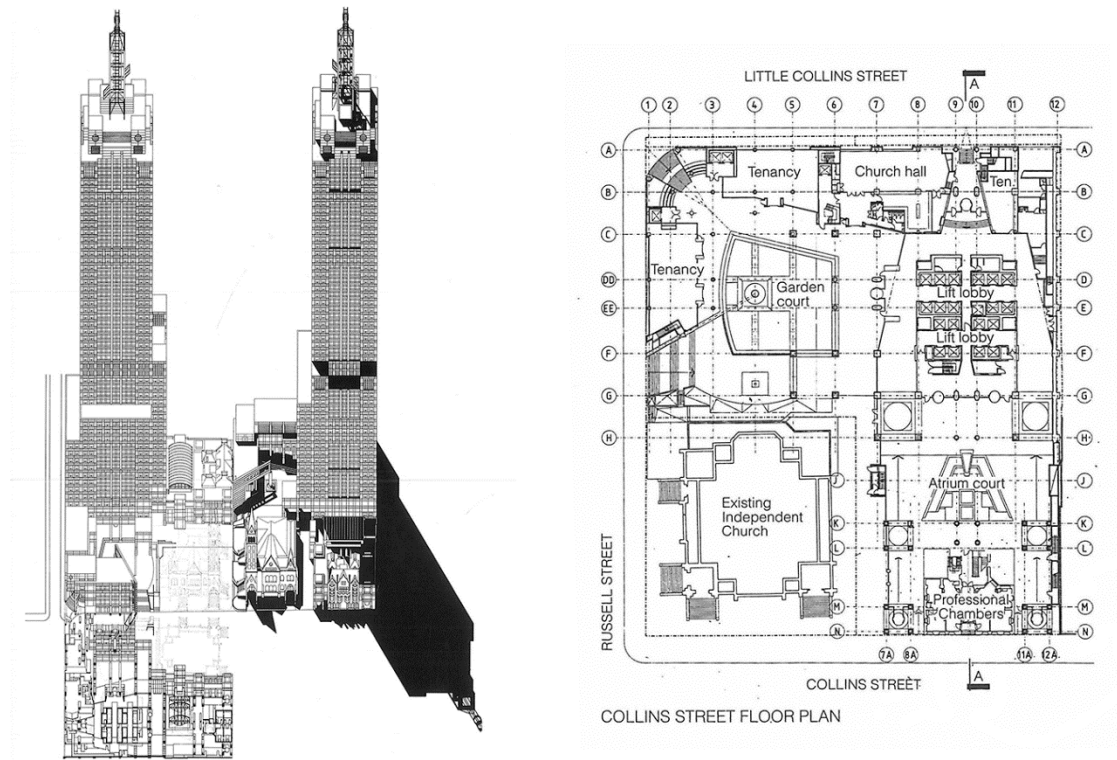


Figure 5.10
120 Collins, 108-120 Collins Street, 1987-1991; axonometric diagram and site plan

In 1986, the site was bought for \$32,000,000 by Foxhina, a company controlled by a building-developer joint venture between Grocon and Consolidated Holdings. The new owners commissioned the design to Daryl Jackson in collaboration with Hassell. The new scheme, 120 Collins Street, was publicised as a building that conformed to the new planning controls. The project was, according to the architect, bound by the “vision of what the city should be” and by the need to build “beyond the commercial concerns of plot ratio and financial return.”⁸¹ Responding to the most recent guidelines of the Department of Planning, the tower was set back from Collins Street, isolated from the main frontage

⁸⁰ PROV, City of Melbourne, VPRS 8945, unit 218, Building and Land Use Committee, Application no. DP83/0143, 30 June 1983.

⁸¹ “120 Collins Street,” *Architect* [Melbourne, Victoria] (August 1991): 10-11.

and yet connected to the side streets by a low rise podium with a cut-off entrance from Russell Street. The facade treatment was designed to reinforce the tower at its corners with polished precast panels that contrasted with the central curtain wall. The mass of the tower was articulated vertically with progressive inward steps that followed the drop offs of the service core.⁸²

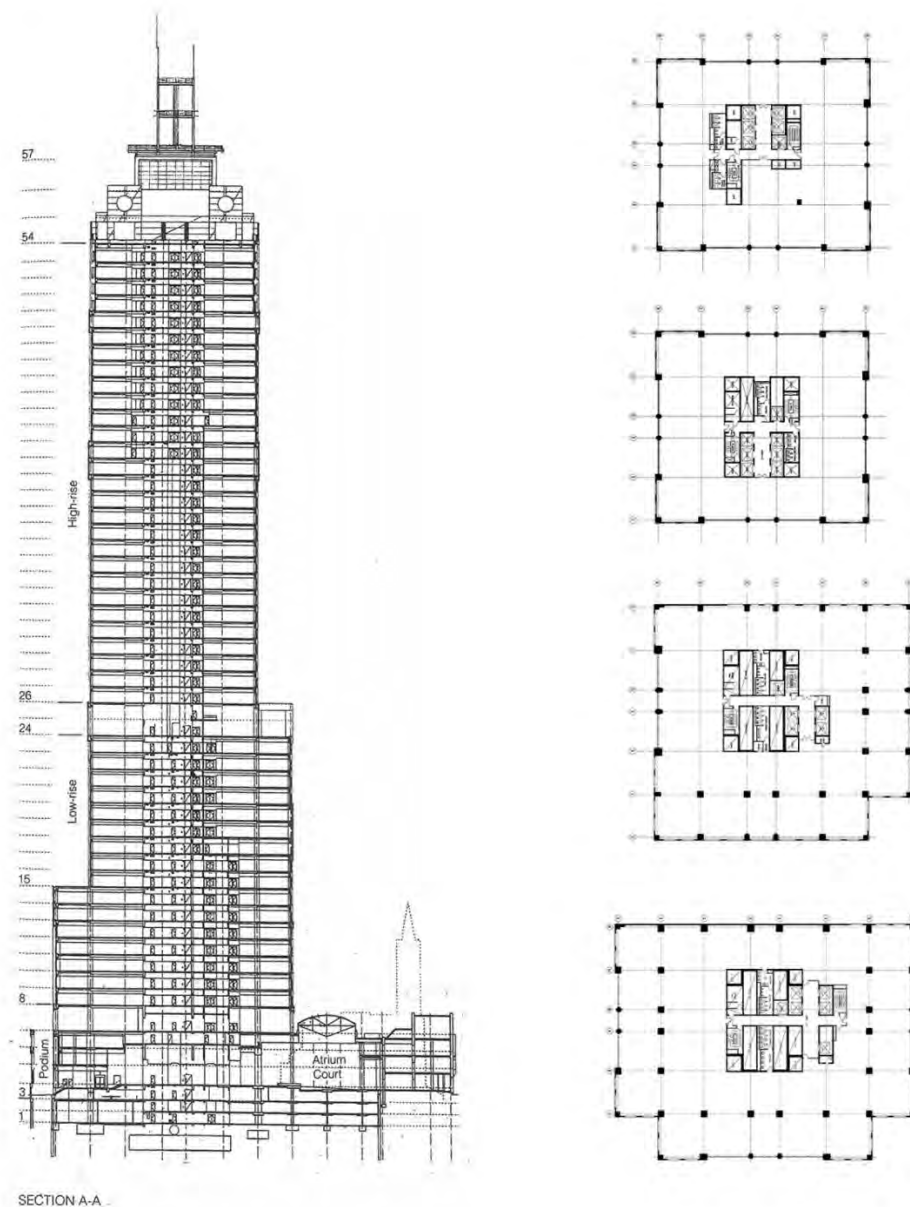


Figure 5.11

120 Collins, section and typical low rise, medium rise, high rise and sky rise floor plans

⁸² Daryl Jackson, interview, Melbourne, 11 September 2014.

The building provided 65,000 square metres of rentable office space with plans of variable efficiency, shape and size. The low-rise podium had very large floor plates with almost 2,000 square metres of lettable area and with 15 metre-deep floor space. The footprint of the tower reduced progressively to a conventional quasi-square centre-core plan of 40 by 36 metres. The floor plate was organised around a structural grid of 8.1 metres and generous all-round open space spanning up to 12.5 metres from the edge beams to the core.

The development was speculative and let to BHP Petroleum as the anchor tenant, which acquired initial naming rights for the complex. The design was amended during construction, first to include a raised floor on the podium floors and then to take a 50 metre-high communication lattice tower on its top. The lattice tower made the project the tallest building in the city when measured at the tip; furthermore, it provided the owner with additional income from the rental of equipment to major telecommunication companies.⁸³ In October 1993, only two years after completion, 120 Collins Street was sold by the developer for \$286,000,000.⁸⁴

CRA redevelopment

In the same years, another major operation of consolidation occurred at the eastern end of Collins Street, on a mid-block site on the southern side, in proximity of the corner with Exhibition Street. In 1985, land developer Carringbush purchased for approximately \$40,000,000 the site occupied by the CRA Building along with several surrounding properties. The land at 89-107 Collins Street was consolidated with 84-116 Flinders Lane into a property of 6,700 square metres that occupied the full depth of the block, from Collins Street to Flinders Lane. The conglomerated site was bounded to the west by the lane of George Parade, and it was served by a not-through lane on the south-eastern corner.⁸⁵

Contemplation of redevelopment for the area of the CRA Building started in the early 1970s, when a planning application was submitted by Harry Seidler on behalf of Conzinc Riotinto. This early scheme proposed to build alongside the CRA a 55-storey building,

⁸³ Steven Richardson, "Constructing 120 Collins Street, 23 Years Later," lecture in Advanced Construction Technology, 2015, semester 2, 3 August, Melbourne School of Design, University of Melbourne.

⁸⁴ Cityscope, map 32, property 24.

⁸⁵ PROV, City of Melbourne, VPRS 8945, unit 236, Development Approvals Committee, report, subject: "Plan of Consolidation at Nos. 89-107 Collins Street and Nos. 84-114 Flinders Lane, Melbourne," 20 November, 1987.

which was part of a two stage project for half of the city block, from George Parade to Exhibition Street.⁸⁶

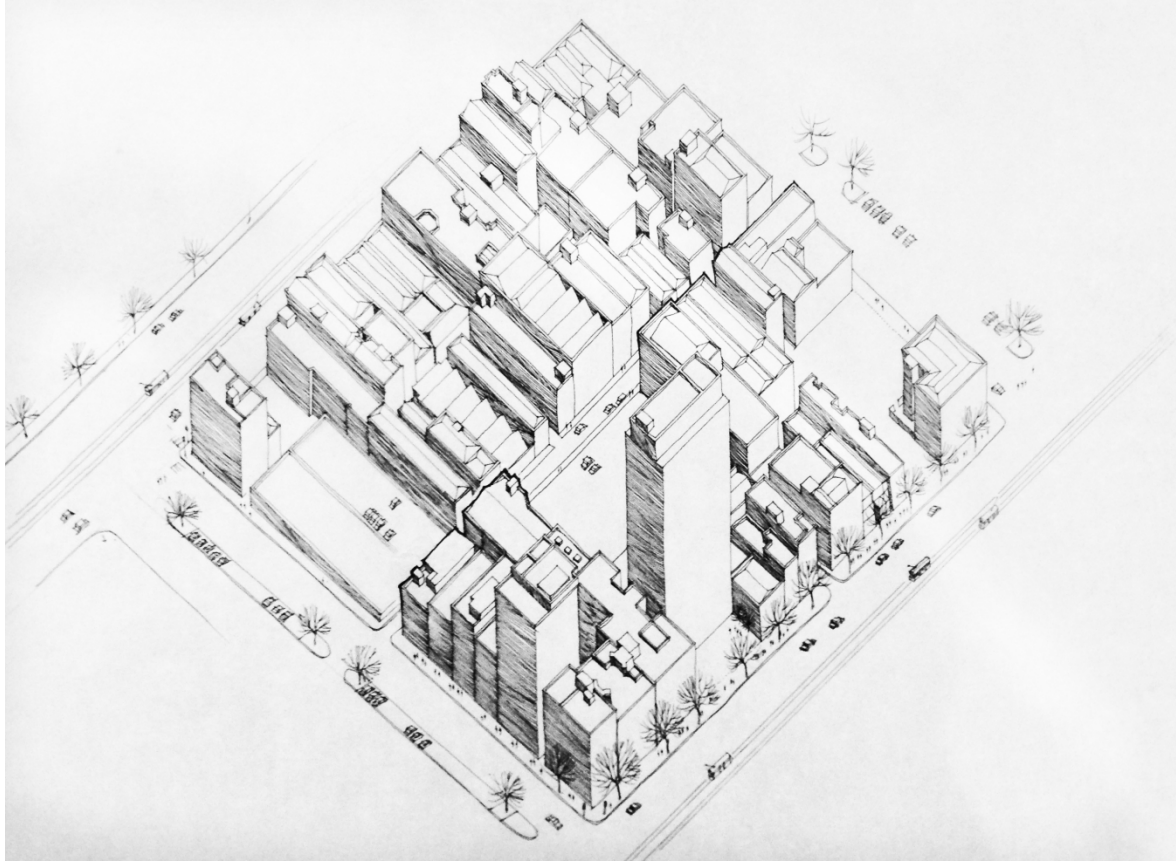


Figure 5.12

City block bounded by Collins, Exhibition, Flinders and Russell Street, including the site of the CRA tower at 89-107 Collins Street; existing conditions, 1983

Another proposal for redevelopment for the site was submitted by Stephenson and Turner in 1983, this time for a 34-storey tower with a sloping top to respect the recently introduced shadow control of the Yarra River. Another scheme of redevelopment, with a strong resemblance to 120 Collins Street, was commissioned later by developer Lustig & Moar Group and it was prepared in the same years by a joint venture formed by architects Daryl Jackson and Godfrey Spowers.⁸⁷

⁸⁶ PROV, City of Melbourne, VPRS 8945, unit 204, Building and Town Planning Committee, Application no. M.C.C. 2314, 1974.

⁸⁷ SLV, Stephenson and Turner Archives, Drawings Collection, "Office Buildings, drawings 071/10, "Conzinc Riotinto of Australia (CRA), CRA Centre Development Project Proposal, Collins Street, Melbourne 1983".



Figure 5.13

CRA Centre Redevelopment proposal prepared by Stephenson and Turner (unbuilt), 1983

In 1985, the new owner of the land, Carringbush, commissioned architects Denton Corker Marshall to design a new speculative project for the area: 101 Collins Street. The client gave instruction to design “the best office building” that could “reflect a Melbourne character” for the “best location” of the city, the “Paris End” of Collins Street.⁸⁸ The scheme proposed a tower on podium with 82,000 square metres lettable area and full demolition of the existing 99 metre-high CRA tower. The tower of 101 Collins Street was a square glass shaft of 41 metres sides articulated by four masonry “buttresses”, which created a cruciform plan with 12 corners per floor.⁸⁹

The planning application of this scheme was approved in 1986, but in April 1987, Carringbush sold the CRA property for \$53,000,000 to the Superannuation Fund

⁸⁸ “101 Collins Street,” *Architect* [Melbourne, Victoria] (August 1991): 12-13.

⁸⁹ “101 Collins Street,” 12.

Investment Trust (SFIT). The transaction was part of deal that included adjoining properties with heritage overlays, a car park property on the opposite side of Flinders Lane, and the acquisition of development rights for a tall building as approved by planning permit.⁹⁰

101 Collins [Map 8C, 71]

In 1987, following the change of ownership, the permit for 101 Collins Street was amended, but the task to design the skyscraper remained with the same architects. The initial concept for a cruciform floor plan was maintained in principle, but the external appearance of the building was changed radically. The plan of the new scheme was enlarged to a 43 by 43 metres square plan with four buttresses that stepped back progressively with height. Floor plates ranged from 1,700 square metres at the low rise section, to 1,800 square metres at the medium-rise, 1,900 square metres at the high-rise and finally 1,500 square metres at the sky rise. Whilst open space was maintained all around the core, space depth varied from floor to floor and spanned from 11 metres up to 18 metres at the buttresses.

The second scheme had inverted the material treatment of the façade. The second version of the skyscraper was wrapped in polished panels of reconstructed granite and buttressed by four protruding elements of metal and glass. The tower was setback from the street and it rose from a 5-storey high podium. The latter was built to the property line to re-establish the “linear street grid of Melbourne” and to repair visually the “unsatisfactory” forecourt of 95 Collins St.⁹¹ The cruciform arrangement of the tower was found favourable for wind conditions due to a “critical edge discontinuity” that reduced substantially cladding pressures.⁹²

The new scheme addressed the unorthodox lift configuration of the Carringbush scheme, which contemplated the use of shuttle lifts and a mid-height sky lobby for the top-most

⁹⁰ Cityscope, map 40, property 25.

⁹¹ PROV, City of Melbourne, VPRS 8945, unit 234, Development Approvals Committee, report, subject: Amended Plans, 101 Collins Street, Melbourne, Permit n. DP 86/0100, 15 July 1987.

⁹² PROV, DP 86/0100, 15 July 1987.

habitable floors. The final proposal was changed with a more conventional arrangement of four lift groups.⁹³

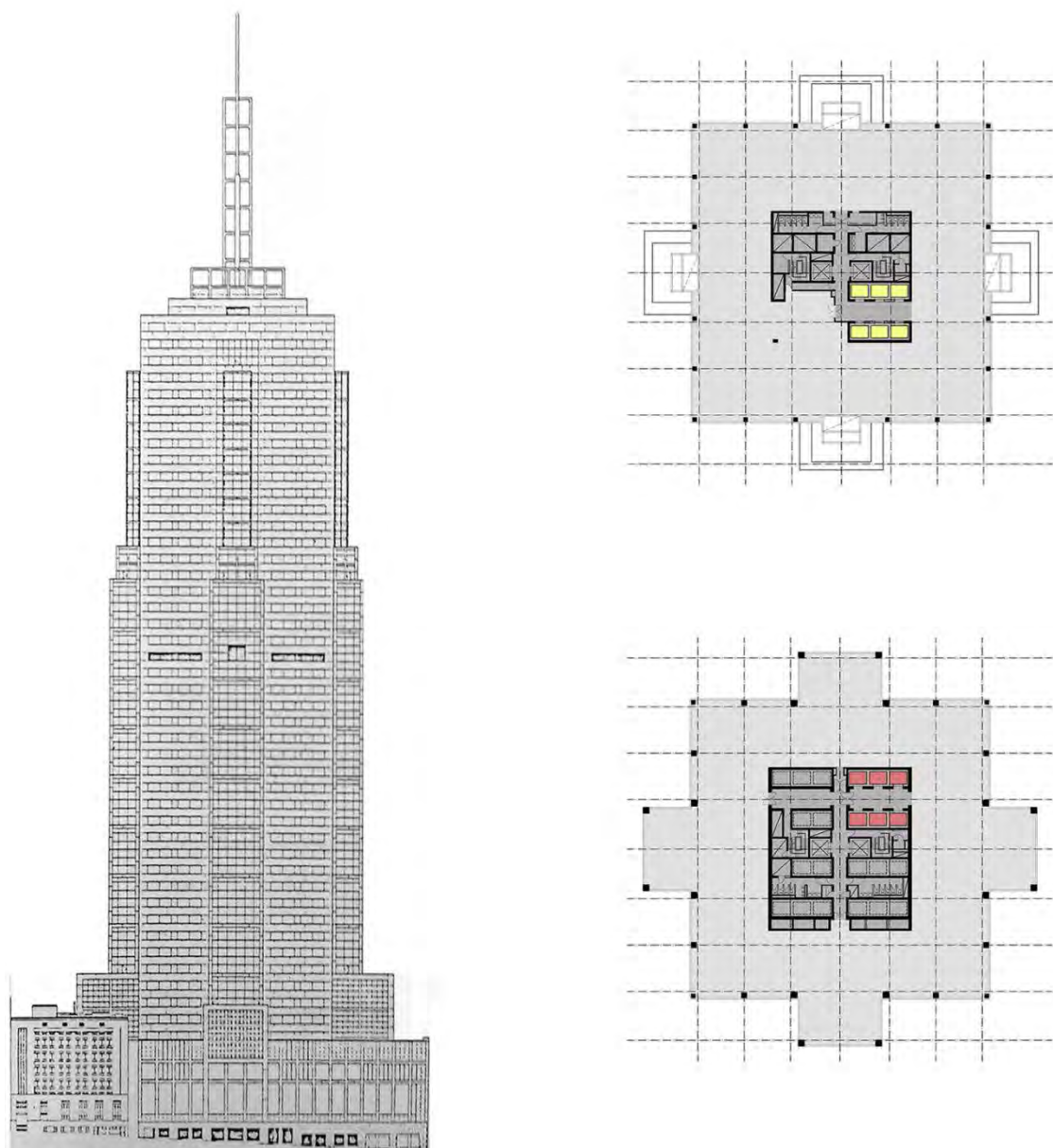


Figure 5.14

101 Collins, 89-105 Collins Street, 1988-91; elevation on Collins Street and typical low rise and sky rise floor plans

⁹³ PROV, DP 86/0100, 15 July 1987.

The project had 1,900 square metres of retail at ground level that faced Collins Street, but this part of the program was not directly accessible from a through-block link that connected Collins to Flinders Lane. Overall, the proposal was found acceptable by the City of Melbourne, but reservations and recommendations were passed to the Planning Minister for lack of activation of the through block link, for the façade design of the podium and for the design of an atrium facing Collins Street, which was assessed as “unacceptable”.⁹⁴ The initial design of the lobby, prepared by Denton Corker Marshall, was also found “not acceptable” by the second client, which subsequently engaged the New York firm of Johnson and Burgee for the neoclassical design of the atrium and for the monumental entrance from Collins Street.⁹⁵

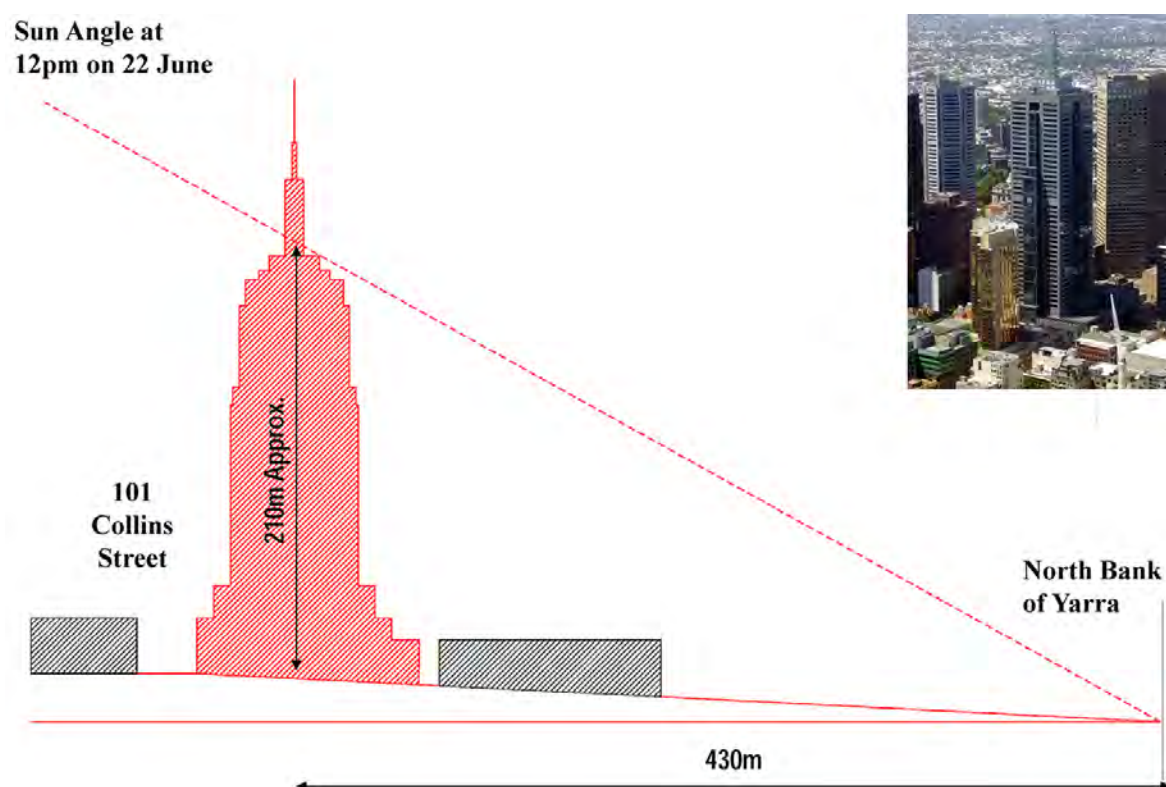


Figure 5.15

101 Collins, section diagram relating building height with built form control of Yarra River

⁹⁴ PROV, City of Melbourne, VPRS 8945, unit 236, Development Approvals Committee, report, subject: City of Melbourne Report, 1 December 1987.

⁹⁵ “101 Collins Street,” 13.

The new scheme had a larger tower footprint than the first one and looked “stumpier” in proportion. It was then later proposed to construct a 65 metre high lattice tower on top of the service core. The lattice tower was in principle against the new built-form provisions of the Melbourne Planning Scheme, according to which “no building” could cast a shadow on the northern bank of the Yarra River. A technical study was commissioned to building science consultants Vipac in order to set out scientifically the criteria for which the shadow projected by a lattice tower could become perceptible.⁹⁶ The report concluded that, in order to project a perceptible shadow on the river in a clear sunny day, an object would require at least a solid thickness of 1.45 metres. This thickness would have to increase to 4.45 metres on an overcast day. Vipac argued that any object at a defined distance and of a lesser width than 1.45 metres, could only create penumbra and not a perceptible shadow on the river. On these grounds, the lattice tower, which varied in width from 1 metre to 400 millimetres, was accepted as a negligible overshadowing element. The City of Melbourne supported the amendment and expressed view that the lattice tower “would enhance the top of the building and lessen the impact of the tower.”⁹⁷

In 1988, with the building still under construction and an anchor tenant agreement still to be finalised, the owner of 101 Collins Street sold 30% of its share to Landsa Pty Ltd, a subsidiary of Kern Corporation. In 1994, after bankruptcy of Kern in 1991, full ownership switched back to SFIT (later renamed CFM Property Fund).⁹⁸

333 Collins [Map 6D, 72]

The process of rejuvenation of Collins Street also advanced west of Elizabeth Street, at numbers 327-343, in a site that had been object of redevelopment interest since the 1970s. Initial plans, however, did not eventuate due to the problem of retention of the historic Banking Chamber of the Commercial Bank of Australia (1891-93). The Chamber was a monumental domed structure designed and built on a pre-existing building of the 1860s that was later demolished. In 1969, after acquiring properties on adjacent sites, the owner

⁹⁶ PROV, City of Melbourne, VPRS 8945/P2, unit 240, Development Approvals Committee, report, subject: “Construction of a 65.0m high Lattice Tower on the roof of the building under construction, 101 Collins Street,” 19 September 1988.

⁹⁷ PROV, “Construction of a 65.0m high Lattice Tower on the roof of the building under construction, 101 Collins Street,” 19 September 1988.

⁹⁸ Cityscope, map 40, property 25.

of the site, the Commercial Bank, decided to redevelop the site and commissioned architects Godfrey Spowers to undertake a feasibility study.

After considering a number of alternatives, these early studies found that it was economically “impracticable” to retain the historic building in a new development. A first proposal of redevelopment, which contemplated demolition of the Chamber, was prepared by Godfrey Spowers in 1972, but remained unbuilt. In 1974, the City of Melbourne, established a Committee of Inquiry to investigate on its own account the feasibility of retention of the Chamber and considered four different scenarios. One of these scenarios contemplated incorporation of the domed Chamber inside a new high-rise building. Economic compensation to offset costs incurred for the retention, such as temporary exemption of annual rates, was excluded. But the Committee of the City of Melbourne suggested that a development that would proceed with the approach of conservation could be granted a relaxation of planning controls with an increase of the plot ratio from 12 to 15.⁹⁹

Another scheme by Godfrey Spowers followed, which incorporated the Chamber,¹⁰⁰ but plans of redevelopment of the site did not come to fruition until the next decade. In late 1987, Becton Corporation purchased the site for \$106,000,000 and lodged a planning permit of redevelopment for 333 Collins Street, a 29-storey high office building with 62,000 square metres of lettable space.¹⁰¹ Becton’s project incorporated the Chamber inside a speculative structure of tiered form, which stepped progressively from a top height of 128 metres on Collins Street and downwards towards Flinders Lane.

The design was commissioned to the Texas-based architecture firm of Shepherd Nelsen and Wheeler and executed in joint venture with local architects Peck von Hartel Trethowan. Brad Nelsen, the American architect in charge of the design, presented the design of 333 Collins Street to local authorities as a building of “recognisable form, rather

⁹⁹ PROV, City of Melbourne, VPRS 8945/P2, unit 204, Building and Town Planning Committee, report, “Conclusions of the Committee of Enquiry Into the Feasibility of Preserving the Banking Chamber, Commercial Bank of Australia Limited, Collins Street, Melbourne,” n. d. [1974?].

¹⁰⁰ John Davidson, interview, Richmond, 28 November 2014.

¹⁰¹ Cityscope, map 37, property 11.

than [of] recognisable height.”¹⁰² The tower differed significantly in typology from the other Big Six projects. It was based on a rectangular layout with staggering volumes that culminated with a copper domed roof that mimicked the historical chamber at ground floor.

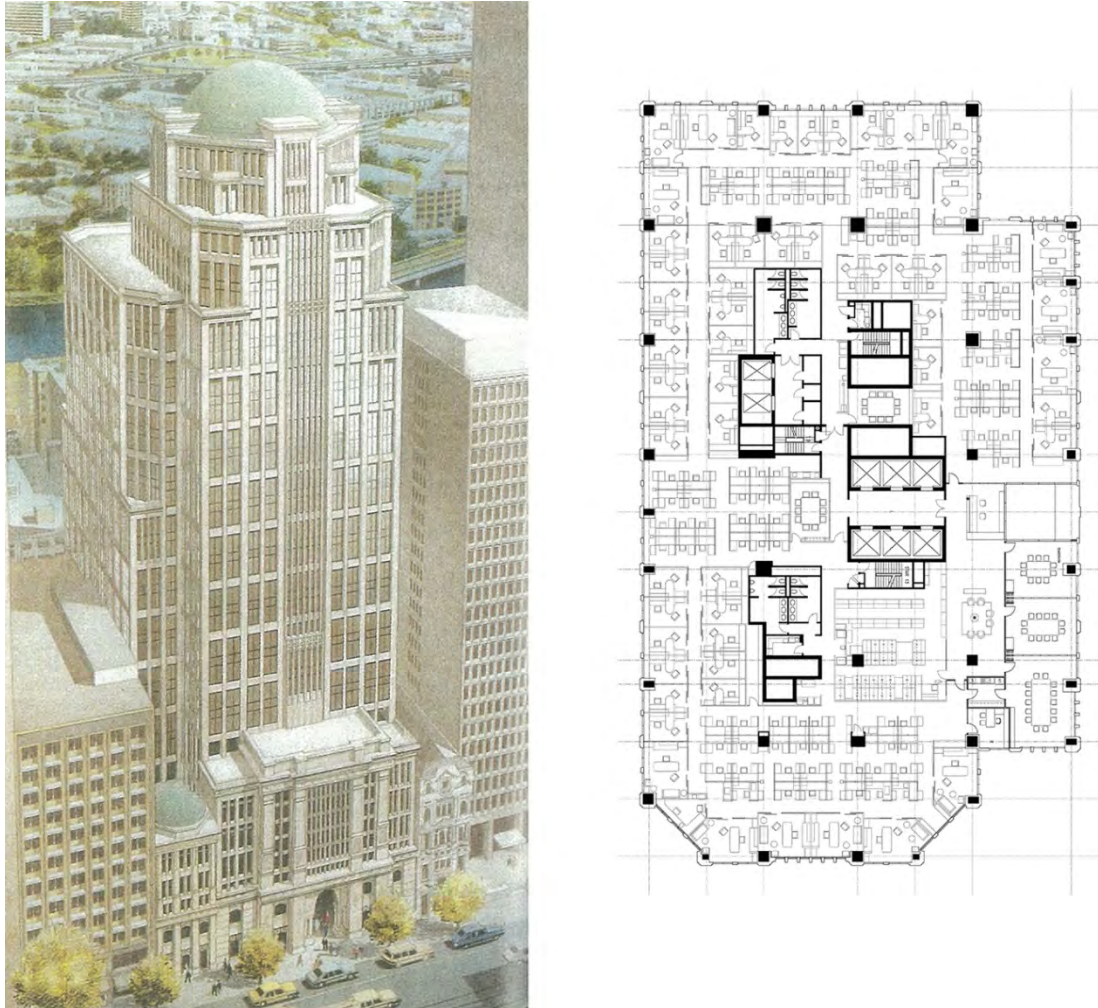


Figure 5.16

333 Collins, 327-343 Collins Street, 1988-92; bird's eye perspective and medium rise floor plan

The project was found to be “acceptable” for its built form by the Urban Design Unit of the City of Melbourne, but strong oppositions were expressed by the Aesthetic Advisory Panel, which described some aspects of the building in “New Orleans Provincial” style as “awful”.¹⁰³ Notwithstanding this opposition and reservations about the high use of the land

¹⁰² PROV, City of Melbourne, VPRS 8945/P2, unit 236, Building and Land Use Committee, Application n. DP/0461, 2 December 1987.

¹⁰³ PROV, DP/0461, 2 December 1987.

proposed - a plot ratio of 15 - the project went ahead and it was completed in late 1990. Following the collapse of a major shareholder that entered in joint venture with Becton in 1988, the building changed ownership several times soon after its completion.¹⁰⁴

530 Collins [Map 5b, 70]

After the completion of Rialto, the transformation of the western end of Collins Street continued. Between 1982 and 1984, the State Insurance Office of Victoria consolidated a number of parcels on the north-eastern corner of Collins and King Streets. Early projects of development for this site were submitted as early as 1981,¹⁰⁵ with a 32 storey-high scheme designed by Gerard De Preu. A later scheme for an office tower of 25 floors was designed by Daryl Jackson and Godfrey Spowers and submitted for approval in 1984, but remained unbuilt.¹⁰⁶ The land consolidated by the State Insurance of Victoria was bought for \$37,500,000 by developer company Dinias and in 1987 and a new project, 530 Collins Street, was commissioned to Peddle Thorp and Learmonth and submitted for approval.

The development consisted of approximately 66,000 square metres of net lettable area distributed over a site-wide podium of 13 floors and a centre core tower of 40 floors and 165 metre height that terminated with a short pyramidal roof top. The office floor of the podium reached up to 3,500 square metres of area per floor that wrapped around a sky lit atrium.

The building offered the biggest floor plates available in the office market of Melbourne.¹⁰⁷ Soon after completion in March 1991, the lower-most areas of the podium were let with naming rights to the Australian Stock Exchange, while over 23,000 square metres of the rest of the project were let to ANZ Bank.¹⁰⁸ The architectural typology of the tower was in line with 120 and 101 Collins. The footprint was essentially square, 42 by 40 metres wide, aligned with the city grid, served by a centre core with three lift groups, and articulated on the perimeter to create a subtle cruciform configuration, which enhanced

¹⁰⁴ Cityscope, map 37, property 11.

¹⁰⁵ PROV, City of Melbourne, VPRS 8945/P2, unit 216, Building and Land Use Committee, Application n. C.M. 3900, 20 February 1981.

¹⁰⁶ PROV, City of Melbourne, VPRS 8945/P2, unit 221, Building and Land Use Committee, Application n. DP84/0143, 30 May 1984.

¹⁰⁷ "The Big Six Office Buildings: 530 Collins Street", 6.

¹⁰⁸ Cityscope, map 32, property 24 [1992].

rentability with up to twelve corner offices per floor.¹⁰⁹ Two years after completion, in 1993, Dinias sold the property to GEM, a commercial property trust, for over \$292,000,000.¹¹⁰

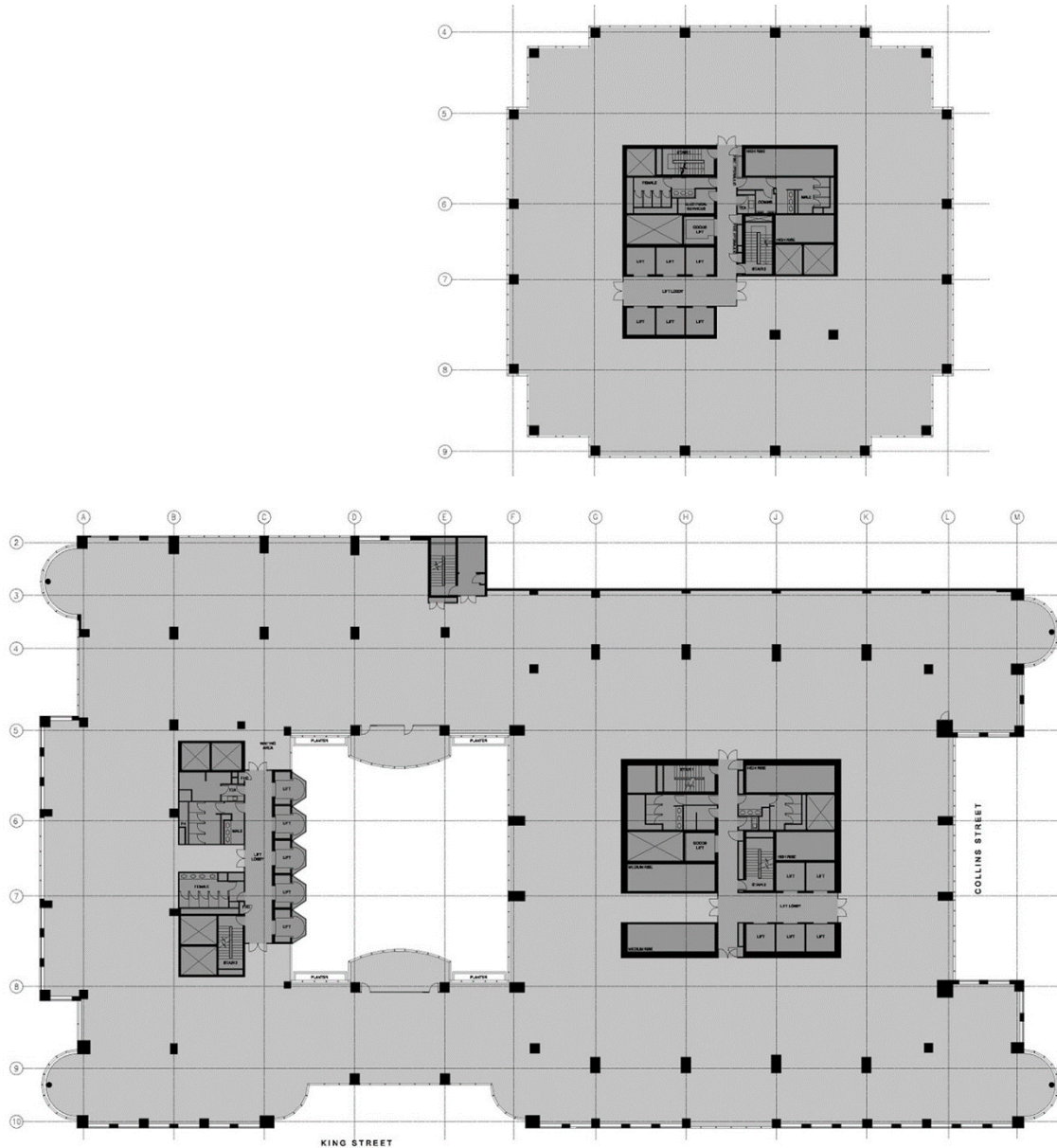


Figure 5.17
530 Collins, 522-534 Collins Street, 1987-91; low rise (podium) and medium rise (tower) floor plans

¹⁰⁹ PROV, City of Melbourne, VPRS 8945/P2, unit 233, Building and Land Use Committee, Application n. DP87/0188, 25 May 1987.

¹¹⁰ Cityscope, map 32, property 24.

Bourke Place [Map 1D, 68]

In the large building activity of the late 1980s, office projects of different sizes were submitted and approved across the entire CBD. While major emphasis for tall office towers was on Collins Street, several smaller office blocks proliferated in the north-western sector of the grid, some along the pre-existing development lines of Queen and Bourke Streets, others along those of Lonsdale and La Trobe Streets. Within a multitude of projects that seldom exceeded 20 floors and 80 metres height [see Appendix B, table B.1], there were another two major skyscraper projects, Bourke Place and Melbourne Central, which showed that the speculative activity of the decade was city-wide, and not limited within Collins Street.

The site at the north-eastern corner of Bourke and King Streets was owned by AMP, which had started activity of property consolidation in the area since 1962. By 1977, AMP owned the parcels facing Bourke Street, which, like most of the properties on the western side of the block consisted of low-rise warehouse buildings of two or three floors. Early permits to develop the Bourke Street side of the land were submitted in 1982 and in 1985.¹¹¹ In 1986, after purchasing 160-180 King Street, AMP acquired frontage on both streets.¹¹²

One early scheme, known as the “Shankly Project” was prepared and lodged for approval by Godfrey Spowers in September 1986.¹¹³ This earlier version of development presented a notable configuration of the tower in plan. A square plan, approximately 38 metres wide, was rotated and superimposed four times, transforming an otherwise ordinary square centre core plan into a star with sixteen points. Some sections of the star dropped progressively with height until the building terminated with a square plan with 8 triangular projections. Only a few months later, in February 1987, the star-shaped Shankly Project was shelved.

¹¹¹ PROV, City of Melbourne, VPRS 8945/P2, unit 224, Building and Land Use Committee, application n. DP 85/0116, 29 April 1985.

¹¹² Cityscope, map 19, property 40, 1986.

¹¹³ PROV, City of Melbourne, VPRS 8945 unit 228, Development Approvals Committee, application n. DP 86/0360, 11 September 1986.

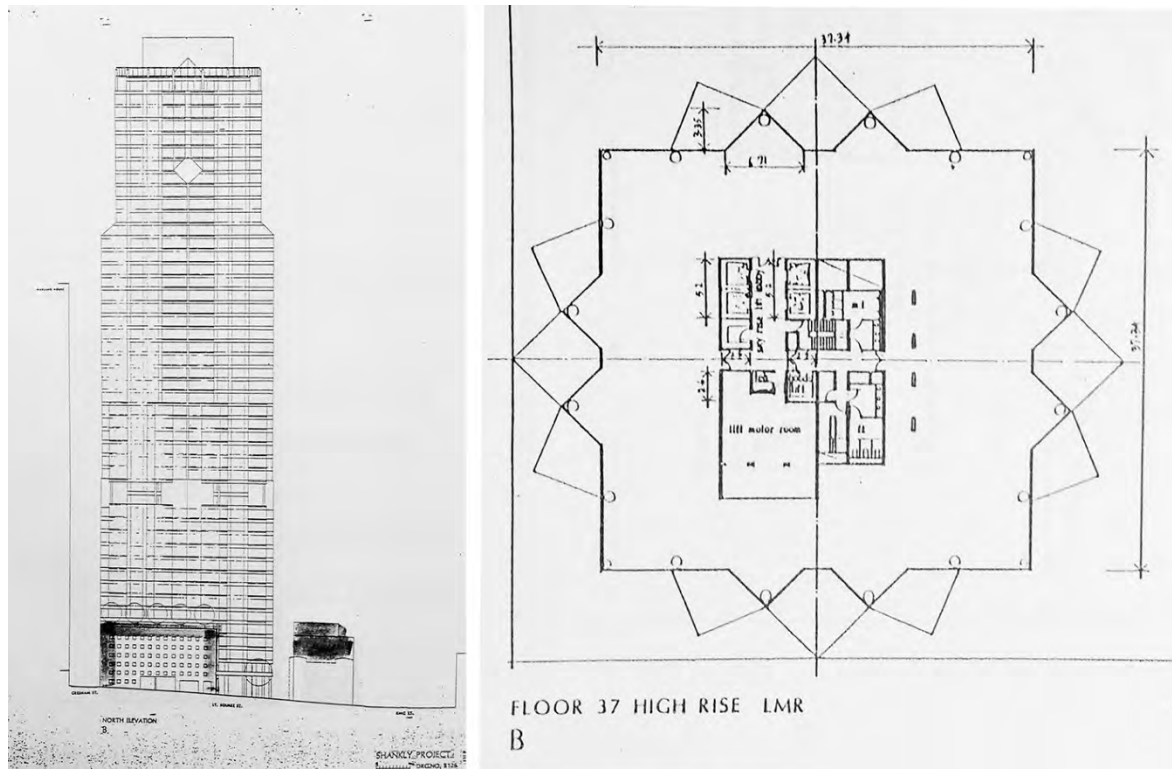


Figure 5.18

The Shankly Project, 578-600 Bourke Street (unbuilt), 1986; elevation on Bourke Street and high rise floor plan

The final scheme, renamed Bourke Place, was amended with a built-form of curved corners that was inspired by contemporary American trends, which the architects had opportunity to witness in person during a trip in North America on behalf of the client.¹¹⁴ With Bourke Place, AMP added another 65,000 square metres of office space to its high-rise real estate portfolio in Melbourne. Almost 26,000 square metres of the high-rise floors of Bourke Place were let to BHP as the anchor tenant, which after settling a court dispute with AMP, had broken the 50 years long lease and management agreement of BHP House, which was vacated in 1990.¹¹⁵

The architectural typology of Bourke Place was based on a conventional centre core square plan of 42 metres sides served by four groups of lifts. Two opposing corners, on the north and south side of the tower, were curved; the other two opposing corners stepped in from the medium rise upwards and created a negative corner that doubled the number of corner-

¹¹⁴ Davidson, interview, 28 November 2014.

¹¹⁵ Cityscope, map 28, property 1 [1977-1995].

offices. The tower was crowned by a raking A-frame with spire, below which – apart from mechanical floors - executive office space was accessible by the service of one express lift.¹¹⁶ Unlike most other developments of the time, AMP retained ownership of the building after completion and continued to consolidate ownership on surrounding properties until the early 2000s.¹¹⁷

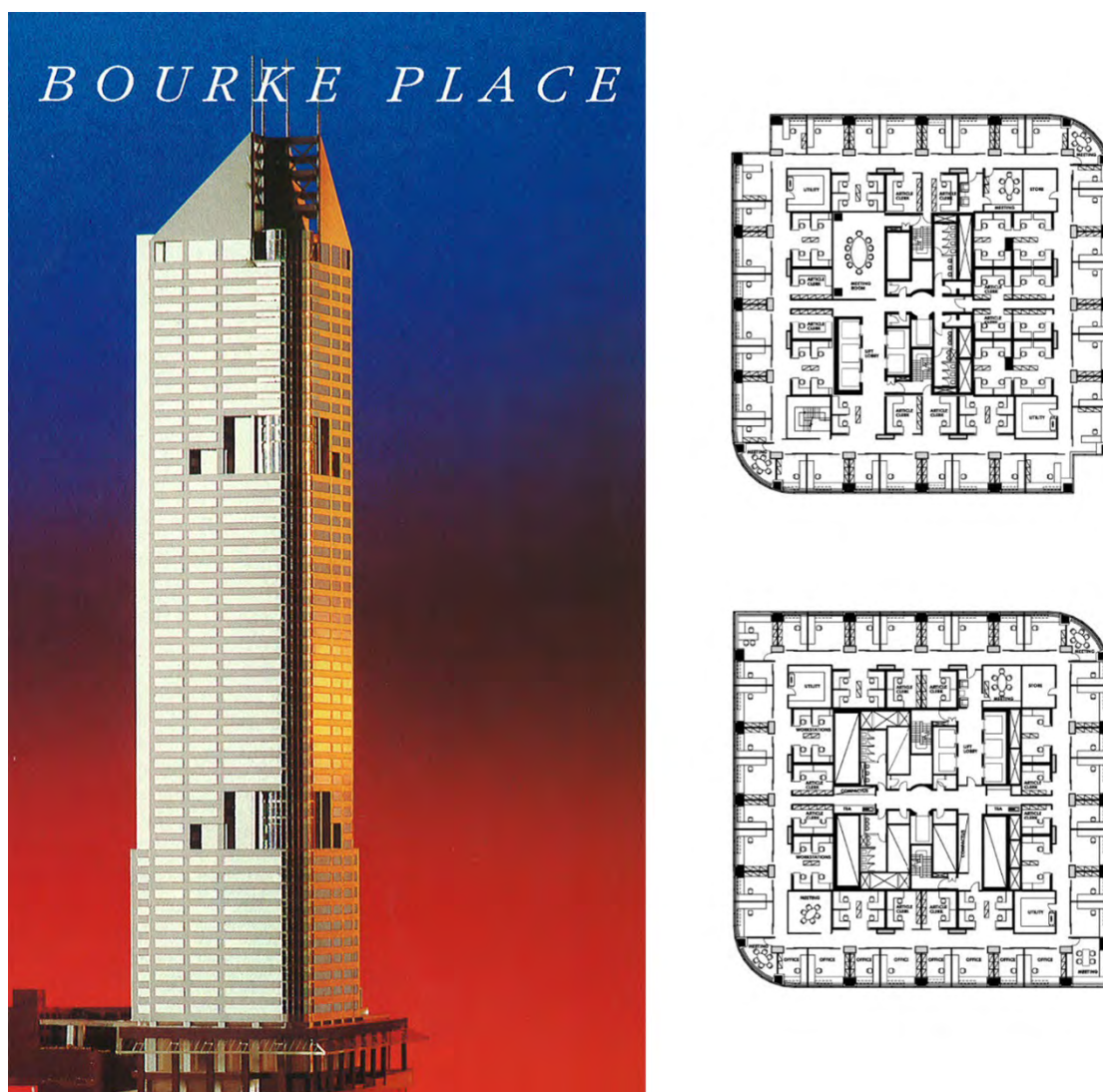


Figure 5.19

Bourke Place, 578-606 Bourke Street, 1987-91; model, low rise and high rise floor plans

¹¹⁶ PROV, City of Melbourne, VPRS 8945/P2, unit 230, Development Approvals Committee, application n. DP 87/0065, 12 February 1987.

¹¹⁷ Cityscope, map 19, property 40 [2000].

Melbourne Central [Map 3A, 66]

The project of Melbourne Central was initiated as a block-wide redevelopment of the “Museum Station Block”, a land owned in prevalence by the City of Melbourne and the Melbourne Underground Railway Loop Authority (MURLA). Following impetus given by the Development Areas Act in 1973 and early master planning suggestions made by the 1974 Melbourne Strategy Plan, a detailed study was commissioned to redevelop the block bounded by Latrobe, Swanston, Elizabeth and Lonsdale Streets. A feasibility report aimed at setting a detailed brief was prepared by George J. Connor and Associates and submitted to Melbourne City Council in January 1974. The report envisaged a development strategy that would unfold in ten to thirteen years.

Among goals of revitalization of northern CBD and the central retail core, the development contemplated the creation of income to offset costs for the construction of the railway loop. The main elements of development consisted of 3.5 million square feet of area given by retail, a department store, an international hotel and office space split into two buildings, one high rise and one medium rise.¹¹⁸

These ambitious plans remained at a briefing level until the early 1980, when the concept coalesced into an architectural vision prepared by Bates, Smart & McCutcheon.¹¹⁹ The first scheme – initially referred as “Victoria Project” and then as “Victoria Central” - incorporated in broad terms the programmatic requirements set in the 1970s. The mixed use development linked pedestrian circulation with the underground railway station and with the arcades and large department stores of two city blocks to the south of the site. The high-rise component of the development went through a series of modifications until it set into a speculative office tower located on Elizabeth Street. In the first scheme of 1981, high-rise space was only allocated in a hotel of 25 floors and 95 metres height.¹²⁰

In 1985, a new scheme, designed and lodged again for planning by BSM, proposed a supertall historicist tower almost four hundred metres high. The central part of the project

¹¹⁸ PROV, City of Melbourne, VPRS 8945/P2, unit 204, Building and Town Planning Committee, Memorandum of the Acting City Planner, Subject: Report to Town and Country Planning Board regarding the area bounded by Latrobe, Swanston, Lonsdale and Elizabeth Streets as a declared Investigation Area, 28 June 1974.

¹¹⁹ PROV, City of Melbourne, VPRS 8945/P2, unit 217, Building and Land Use Committee. Application n. C.M. 4909, City of Melbourne Report, 2 December 1981.

¹²⁰ PROV, C.M. 4909, City of Melbourne Report, 2 December 1981.

had a 100 metre high atrium, which incorporated the historic Shot Tower - the industrial remains of a 50 metres high brick tower of the 1800s - and a 142 metre new hotel slab with frontage on Swanston Street.¹²¹

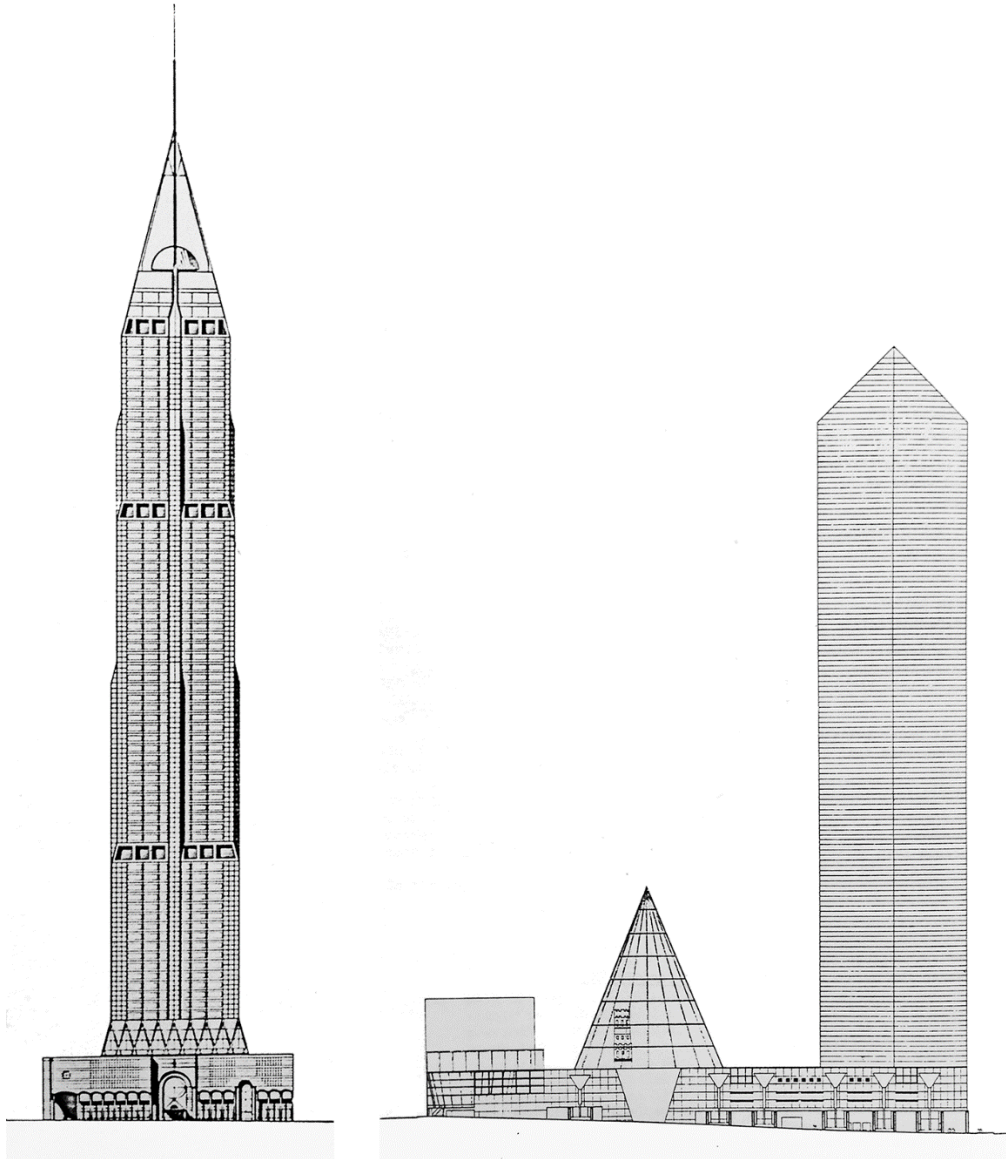


Figure 5.20

Victoria Central (later Melbourne Central), 1985; early schemes (unbuilt) prepared by Bates Smart McCutcheon (left) and Kisho Kurokawa (right)

¹²¹ PROV, City of Melbourne, VPRS 8945/P2, unit 223, Building and Land Use Committee, Memorandum, Subject: Proposed Amendment No. 27, Victoria Project (site bounded by La Trobe, Elizabeth, Lonsdale and Swanston Streets) undertaken by EKG Developments Pty Ltd, 4 March 1985.

In the same years, ownership and modality of finance of the project changed. Although the initial plans deemed the concept of a public and private joint venture as “not practical”¹²², in the mid-1980s, initiatives regarding Victoria Central shifted progressively into private hands: firstly with the involvement of EKG developments and later with that of Japanese developer Kumagai Gumi, which took eventually full ownership and control of the property in late 1985.¹²³ The Japanese developer engaged the architectural services of Kisho Kurokawa Consultants from Tokyo, which at first revised the overall scheme and condensed the high-rise component into an office tower of 72 floors and 288 metres height.¹²⁴

Kurokawa described the project as a “symbiosis” of “old and new” between “retail and office”.¹²⁵ The Japanese architect considered generally these two functional realms in opposition, but, in his view, the new design reconciled them visually with the form of the tower and that of a conical, sky-lit atrium over the Shot Tower. The office tower rose from a square footprint of 42 metres; it was chamfered, but only at two opposing corners, and rotated at forty five degrees from the city grid. The tower terminated with a pitched top that was shaped, in combination with an ostensible use of reflective glass, to evoke, in the architect’s own words, the image of a “crystal cut”.¹²⁶

Kurokawa’s scheme, as submitted at first to the City of Melbourne, emphasised the purist volumetry of the tower with the horizontal expression of joints in the curtain wall. In virtue of this and other aspects of the proposal, the Japanese-designed amendment of “Victoria Project” attracted vehement opposition and criticism from local authorities. The Urban Design Unit of the City of Melbourne commented negatively against the concept, which was found to be of “far less visual quality than the previous one” – the supertall post-modern design of Bates Smart and McCutcheon - which instead had a more “distinctive composition of “base, stem and top”.¹²⁷ Commentary went on describing Kurokawa’s scheme as a “rudimentary commercial office building with a typical floor repeated over

¹²² PROV, VPRS 8945/P2, unit 204.

¹²³ Cityscope, map 14, property 1.

¹²⁴ “Melbourne Central,” *Architect* [Melbourne, Victoria] (August 1991): 17.

¹²⁵ “Melbourne Central,” 17.

¹²⁶ “Melbourne Central,” 17.

¹²⁷ PROV, City of Melbourne, VPRS 8945/P2, unit 227, Development Approvals Committee, memorandum, subject: ‘Victoria Project, Scheme No. 2’, 12 May 1986.

almost its entire height” and concluded that the project would be of “considerable detriment” for failing to be ‘in tune’ with Melbourne’s unique urban characteristics.”¹²⁸

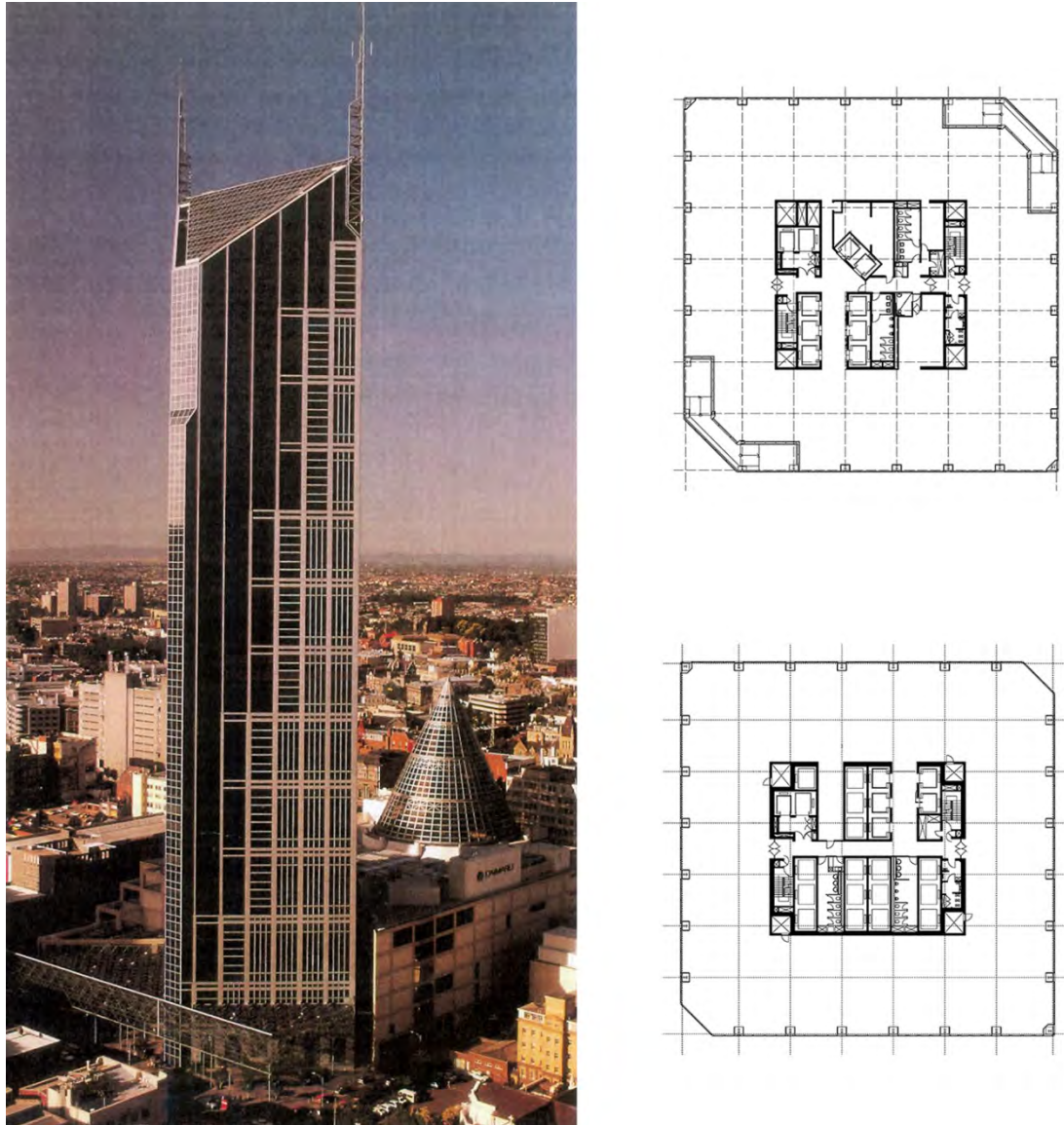


Figure 5.21

Melbourne Central, 316-342 Elizabeth Street, 1985-92; aerial view, low rise and high rise floor plans

Even blunter comments were expressed by the Aesthetic Advisory Panel that considered the design defective and hurriedly conceived.¹²⁹ The AAP mentioned by comparison the redevelopment of the CRA site – 101 Collins Street - where, according to the

¹²⁸ PROV, ‘Victoria Project, Scheme No. 2’, 12 May 1986.

¹²⁹ PROV, ‘Victoria Project, Scheme No. 2’, 12 May 1986.

commentators, more “effort and ingenuity” had been applied by the local designers.¹³⁰ By contrast, Kurokawa’s concept was described as “typical of the self-contained corporate Japanese buildings likely to be found in Japan itself, and having little to do with life in Melbourne’s streets.”¹³¹

The scheme went into a further stage of amendments. In the final form, the tower was reduced considerably in height, enlarged slightly in footprint and topped by two trussed horns that projected vertically from two corners. Kurokawa reviewed also the façade treatment with a compositional pattern of vertical aluminium bands that he explained as an attempt to “reach towards the sky” and with the aim of describing, in the architect’s own words, “a story of architecture to people.”¹³²

Soon after completion, the commercial tower of Melbourne Central followed the fate of the retail component of the development, which was let to Japanese department store chain Daimaru. In 1993, the property was already effectively for sale and, after a decade of commercial losses by Daimaru, Melbourne Central was sold by Kumagai Gumi in 1999.¹³³

5.4 Epilogue

Bulldozers at the corner of Bourke and William

More mega-buildings

The concomitant construction of six large speculative towers, each with more than 60,000 square metres of rentable area, poured into the city a disproportionate amount of office space. The six mega-projects raced against time in a “battle of giants” for securing anchor tenants; soon it became clear that the supply of office space was much more than could be absorbed by the CBD market.¹³⁴ In January 1991, BOMA reported that, in a situation of growing vacancy rates, the over-supply was so severe that “it could take 10 years to fill”.¹³⁵ BOMA stated that most of the supply of the year was created in particular by the new “landmark” buildings of Collins and Bourke Streets and that sixty percent of the space

¹³⁰ PROV, ‘Victoria Project, Scheme No. 2’, 12 May 1986.

¹³¹ PROV, ‘Victoria Project, Scheme No. 2’, 12 May 1986.

¹³² “Melbourne Central,” 17.

¹³³ Cityscope, map 14, property 1.

¹³⁴ Ian Rust, “Real Estate,” *Architect* (October-December 1988): 24-25.

¹³⁵ Tim Graham, “Melbourne’s office space could take 10 years to fill,” *The Age*, February 27, 1991.

of these building had already been committed.¹³⁶ The Big Six, as some real estate experts had anticipated, weathered the market storm they created, and much of the “digestion pain” of the oversupply shifted to a myriad of “smaller or lessor” developers of office buildings that were completed in the same period.¹³⁷

Melbourne’s post-modern ‘mega-building’ development model, however, did not end with the Big Six. Despite pessimistic indications of imminent downturn, a handful of large office development projects continued to be approved in the early 1990s. The typology of these developments followed programmatic, built form and urban design paradigms established by the landmark towers just completed. But the finality of the development shifted from real estate speculation to owner-occupied investment.

The long stream of office building projects that had grown relentlessly in the CBD from the mid-1980s, was then brought to a final leg by three more skyscrapers. Two of these - Casselden Place and Telstra Centre [Map 4B, 74, 75] - were initiated by a Government release of public land and for occupancy by public agencies.¹³⁸ The two projects were criticised for being untimely. Publicly-driven development was considered an exacerbating factor of the oversupply that affected private developers. At BOMA, it was felt that the severity of the oversupply could have been mitigated if Government had chosen to rent space in recently completed private developments rather than to develop public land for new towers.¹³⁹ Private speculative development was, however, still a vital driver of the transformations in the CBD and the third project of the early 1990s, at 74-110 Queen Street, was developed privately for owner-occupation by ANZ Bank. [Map 6B, 76]

Grand Central

Private and public interest continued to be an object of negotiation at the onset of tall office building developments in Melbourne until the 1990s. Some aspects of the dialogue between authorities and architects were eminently cultural and verged on aesthetic matters, as public authorities tried to heavily influence the work of architects, like in the case of one unbuilt landmark project: Grand Central.

¹³⁶ Graham, “Melbourne’s office space could take 10 years to fill”.

¹³⁷ Rust, “Real Estate,” 34.

¹³⁸ City of Melbourne and Ministry for Planning. *Commonwealth Block Plan*. (Melbourne: City of Melbourne 1985).

¹³⁹ Graham, “Melbourne’s office space could take 10 years to fill”.

From the late 1960s until the 1970s, the intersection of Bourke and William Streets surged as the hub of prestige office building development of the city. In the late 1980s, in the shortness of five years, the area lost its position as the theatre of pace-setting skyscraper activity. The new large landmarks of the 1980s, built chiefly along the 'high ends' of Collins Street, shifted the epicentre of prestige away from the American-designed cluster of Shell, AMP and BHP. The Big Six provoked a chain reaction that affected office buildings in the area in two ways. On the one hand, the north-western corner of the intersection, which was relatively under developed in comparison to the other three, became the object of redevelopment plans. On the other hand, the competition brought by new buildings subtracted some of the prestige held by the largest buildings in the area, which in turn lost key tenants and prospects of rentability, as occurred at BHP House.

In the late 1980s, Lend Lease started an operation of consolidation on the eastern side of the city block at the north-west corner of Bourke and William Streets. Between 1987 and 1988, the Sydney-based developer purchased all land parcels situated to the east of Marland House [see appendix D, map 1]. The older headquarters of ACI, which had sold the property in 1982 and relocated as ACI-Pilkington at 200 Queen Street, were acquired by Lend Lease in 1987 for \$32,000,000. In the same year, Lend Lease purchased for \$30,000,000 the properties of Shell along William Street. Shell had bought the corner building earlier from MLC in 1982 in order to acquire the right to end a long-term lease agreement of 40 years occupancy that was established in 1960. In 1988, Lend Lease completed the operation of consolidation by purchasing the remaining properties on the north-eastern corner of the block. These included Hume House [Map 1, 5], which Humes had earlier sold in 1972 to National Mutual Life while retaining a lease-back option for another 10 years. Hume House was eventually purchased for \$20,000,000 from Sedwick, which had acquired the property in 1983.¹⁴⁰ The consolidated site of over 7,600 square metres area incorporated also the secondary street of Goldsbrough Lane, which Lend Lease sought to discontinue after purchasing from the City of Melbourne.

Sunset clause

Lend Lease commissioned Harry Seidler to design an office tower that would surpass in height and size any other surrounding tall structure, including the nearby AMP-owned

¹⁴⁰ Cityscope, map 19, properties 50-55 [1987-1999].

Bourke Place. The proposal was presented to city authorities in 1989. The site was to be developed with over 90,000 square metres of gross floor area in respect to a maximum plot ratio of 12. The program included 68,000 square metres of net lettable office space in a tower and 7,000 square metres of public space including retail, restaurants, a theatrette, video conferencing facilities and professional suites in a five level podium building. The tower of 57 floors was 213 metres high and terminated with a spire reaching 250 metres at the tip. The plan shape of the tower was irregular and rotated in relation to the city grid. The typical floor plate was formed by two staggered trapezoids linked by a central service core with four lift groups.¹⁴¹

In response to the project, the City of Melbourne expressed an opinion of support “in principle” for the redevelopment with a “landmark” project in the area and confirmed to have no objection for the demolition of all existing buildings on the site, including the relatively recent office towers of ACI, Shell and Hume.¹⁴² The modernist building of Shell Corner was then hastily demolished in 1989. But Lend Lease eventually decided to defer the project in 1992, leaving the parcels that had been consolidated in a state of underdevelopment and underuse for the rest of the 1990s.¹⁴³

Notwithstanding the openly declared intention of planning authorities to support the redevelopment of the area, many aspects of the detailed design of Grand Central were strongly opposed by the Urban Design Unit of the City of Melbourne. The tower was defined as potentially “dull or sinister” for its choice of low-reflective polished grey granite.¹⁴⁴ Most of all, opposition was expressed with a lengthy list of concerns related to the design of the podium façades on Bourke and William Streets. Objections were expressed as an attempt to guide Seidler into a review of the architect’s compositional vocabulary. According to the commentator of the Urban Design Unit, parapets should have been stepped rather than sloped, and “greater definition” should have been brought on elevations with “corner treatment”, “use of punched windows”, inclusion of “vertical

¹⁴¹ PROV, City of Melbourne, VPRS 8945, unit 244, City Development Applications Committee, application n. DP/002, 6 February 1989.

¹⁴² PROV, DP/002, 6 February 1989.

¹⁴³ Cityscope, map 19, properties 50-55 [1987-1999].

¹⁴⁴ PROV, DP/002, 6 February 1989.

elements to break up” and “detailing around openings so as to provide greater interest.”¹⁴⁵ Among these and other recommendations to the office of the Planning Minister, the Urban Design Unit proposed to include a “sunset clause” motivated as “incentive for [the developer] and their architects to move quickly to finalise”.¹⁴⁶ The clause was suggested as a conditional trigger for the release of the permit “on the understanding that these issues will be addressed and if they are not addressed within a period of two months, the permit automatically lapses.”¹⁴⁷

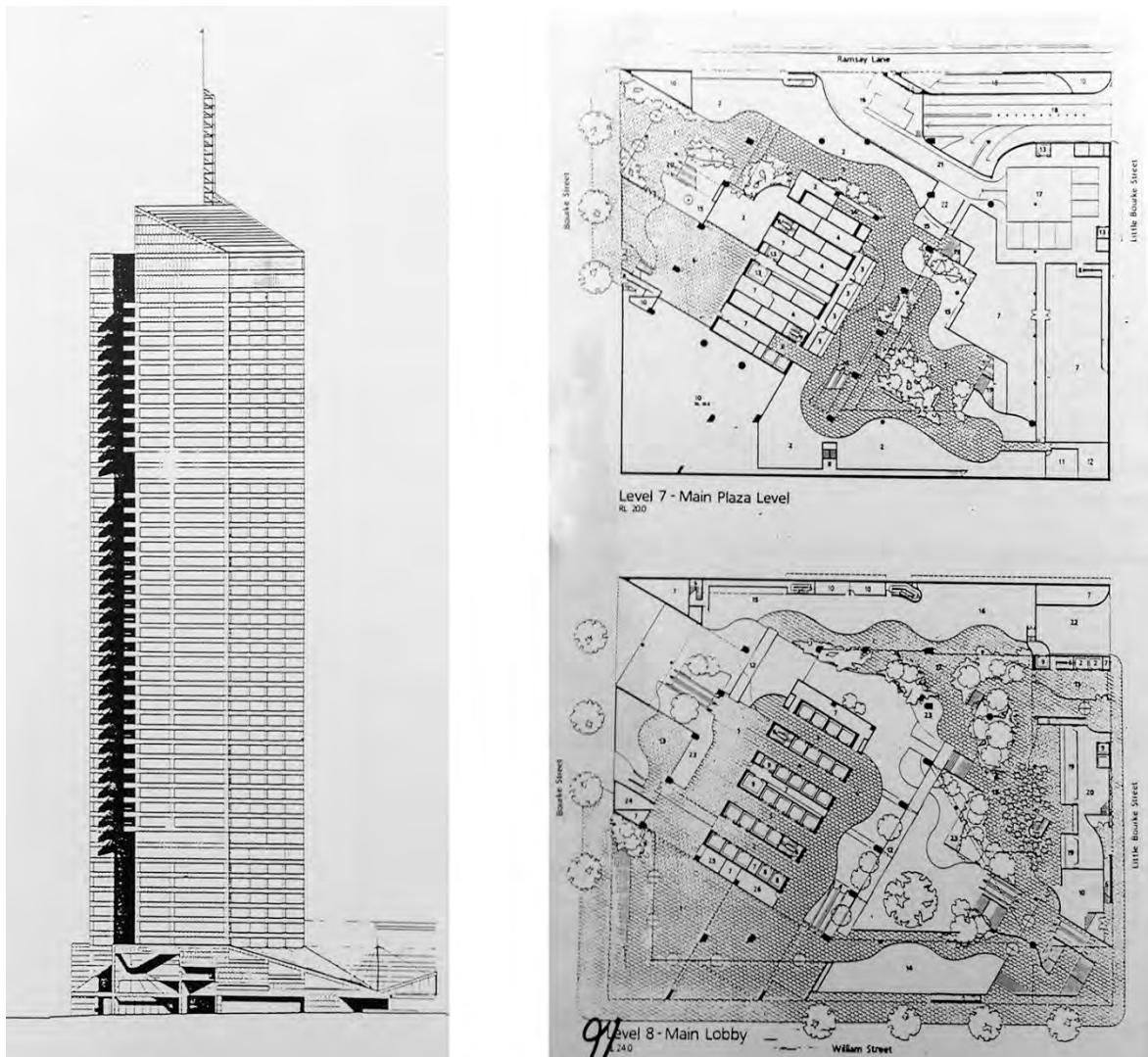


Figure 5.22

Grand Central, 316-342 Elizabeth Street, 1989; elevation and plans at ground and upper plaza levels

¹⁴⁵ PROV, DP/002, 6 February 1989.

¹⁴⁶ PROV, DP/002, 6 February 1989.

¹⁴⁷ PROV, DP/002, 6 February 1989.

New Shell Headquarters [Map 8D, 67]

In the 1980s, conflicts between authorities and architects, such as the ones that emerged for the unbuilt proposal of Grand Central, were anticipated by another episode. In fact, disagreements between the City of Melbourne and architect Harry Seidler had originated before, when a difficult relationship arose during the process of approval of another tall office building commissioned from Gegana, a company controlled by the Grollo Group.¹⁴⁸ On the site located at the corner of Flinders and Spring Streets, Seidler was engaged to design a new building to be rented by Shell, which at the time was in search of new and larger headquarters after vacating from the building in William Street.

Strong opposition against the Shell project was expressed by the City of Melbourne and was voiced through the commentaries of the Urban Design Consultant and the Aesthetics Advisory Panel. Authorities found the project, an S-shaped slab with side core and open plaza at ground floor, to be needy of major redesign, given the importance of the site at the corner of the Hoddle grid. The AAP suggested a terraced built-form was more appropriate, rather than the “flat top” termination of a tower that Seidler conceived as freestanding and surrounded by open space at ground.¹⁴⁹ Moreover, the slab was described as “selfish in concept” and “ungainly” for erecting tall blank walls along boundaries.¹⁵⁰ The project underwent some modifications. Notably, a built up landscape platform along Flinders Street was made to address pedestrian comfort against wind downwash, but in essence the Planning Minister overruled suggestions from the City of Melbourne and allowed the tower to be built in line with the initial vision of the architect.¹⁵¹

Seidler engaged thereon in a public polemic against post-modern inspired planning authorities, and those of Melbourne’s controls in particular, which he considered reactionary and anachronistic. In 1988, this polemic was taken up by Seidler at the World Conference of the CTBUH:

Demonstrating the speed and effectiveness with which the media today disseminate these dissenting notions is the evidence offered by authorities in Melbourne, Australia, in their

¹⁴⁸ PROV, City of Melbourne, VPRS 8945/P2, unit 218, Building and Land Use Committee, application no. DP83/0074, 14 April 1983.

¹⁴⁹ PROV, City of Melbourne, VPRS 8945/P2, unit 225, Building and Land Use Committee. Application n. DP85/0303, 16 September 1985.

¹⁵⁰ PROV, DP85/0303, 16 September 1985.

¹⁵¹ Melbourne, interview, 24 February 2015.

objections to a large city building. They quote, verbatim, the recently implemented San Francisco plan and insist that this incredibly reactionary set of new rules imported from the United States be adopted, such as, prohibiting buildings with flat roofs or any blank walls, and calling for “a generous use of decorative embellishments.” To demonstrate what benefits are offered in return, these decorations are even allowed to protrude outside the zoning envelope!¹⁵²

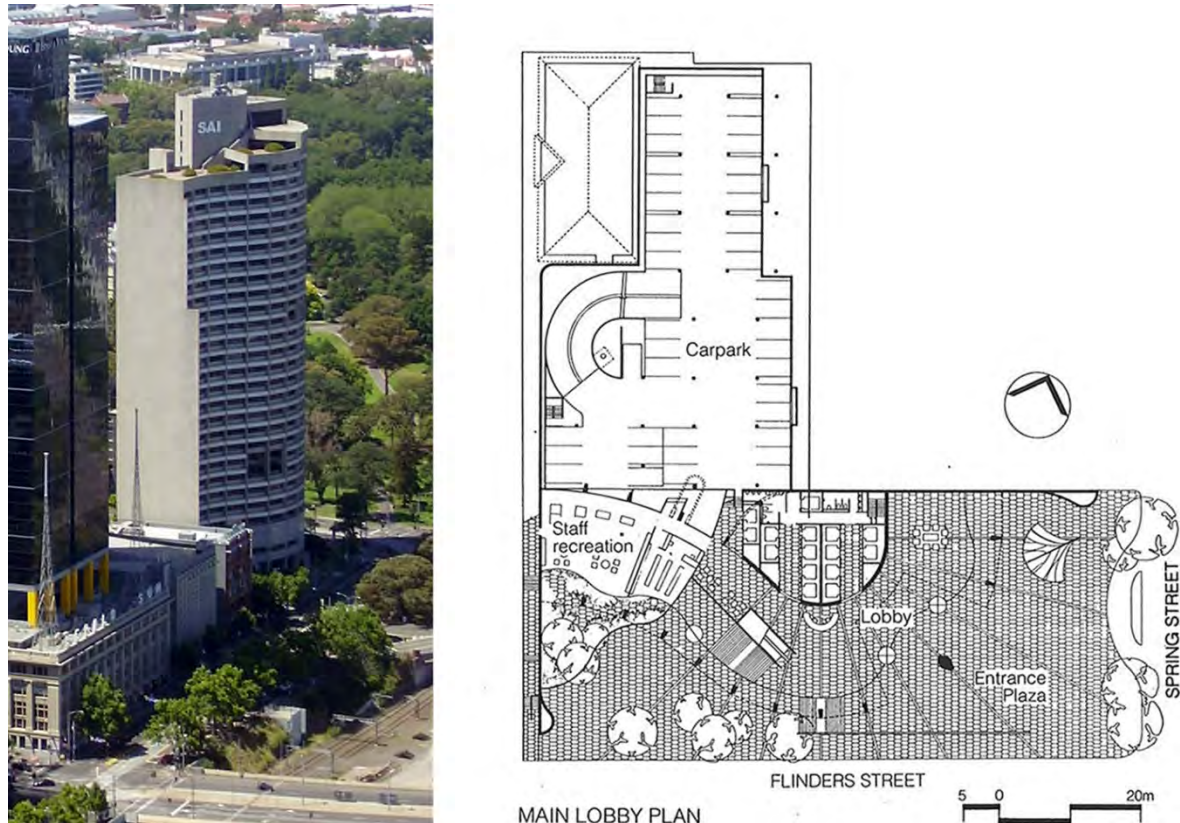


Figure 5.23
Shell Headquarters, 1-11 Spring Street, 1986-89; aerial view and ground floor plan

The polemic continued locally, when the architect commented about the project in *The Age* and epitomised recent Melbourne’s planning policy as an “edict”.¹⁵³ At number 1 Spring Street, the vehement opposition from Melbourne City Council was eventually over-ruled by the permit granted by the Minister and after completion the project, with its S-shaped side core slab on Spring Street was awarded professional recognition from the RAIA.¹⁵⁴ In the midst of a trail of unbuilt Seidler-designed proposals for Melbourne, which dates from

¹⁵² Harry Seidler, “A Perspective on Architectural Directions,” in *Second Century of the Skyscraper*, edited by Lynn S. Beedle (New York: CTBUH 1988), 165.

¹⁵³ “Architect opposes city planning edict,” *The Age*, April 6, 1989, 31.

¹⁵⁴ “Architect opposes city planning edict,” 31.

the 1950s,¹⁵⁵ the Shell Headquarters of Spring Street was the only high-rise project designed by the Sydney-based architect that was built in Melbourne's CBD.

Conclusion

From the 1980s to the early 1990s, the Central Business District of Melbourne was transformed by a new generation of multi-storey office buildings, the third since the end of World War II. The greater majority of tall building activity of the period was initiated for speculative purposes by a multitude of developers, among which an important share was taken by superannuation funds. [See Appendix F, table F.11]

Owner-occupied tall building projects virtually disappeared from the CBD in the 1980s, but re-emerged, although to a minor extent, in the early 1990s. Private development interest played a leading role in the transformation of the city, but notable impetus was given by block-wide redevelopments initiated on public-owned land, such as Melbourne Central and the redevelopment of the north-eastern end of Lonsdale Street.

Breaking with the trend established in the 1960s to develop and hold property for long term investments, the speculative land owners of the 1980s, engaged in short-term large-volume forms of investment, as testified by recurring patterns of property transactions before, during and soon after completion of projects and as attested by the vicissitudes of the "Big Six", the largest tall office building projects of the time.

The new wave of tall construction activity conjoined chiefly along the high ends of Collins Street, while the cluster of towers that rose on Bourke and William Streets during the 1970s declined. In fact some prestigious tenants located in the area since the 1960s, such as ACI, Shell and BHP, left to relocate on new and larger landmark buildings completed in the early 1990s and located mostly in Collins Street. Not all office building activity comprised landmarks, though; second-tier multi-storey office developments sprawled in other areas of the city, particularly along La Trobe Street and in the north-eastern end of the CBD. [See Appendix B, table B.1]

¹⁵⁵ Besides Grand Central, Seidler designed an innovative office block, Fuller House, in Little Collins Street, in 1955, he was involved in schemes for the CRA site in the 1970s, and he was engaged by Grollo for the first vision of the Grollo Tower in the 1990s.

During the 1980s, tall office buildings development continued to affect lands of size larger than in the past and because of extensive operations of property consolidation on major corner sites. Most frequently, the blocks of land developed with the skyscrapers ranged from 4,000 to 8,000 square metres. The use of the land continued to densify the inner city district in line with base plot ratios of 6, which in most cases were increased to 12 due to bonuses given at the discretion of planning authorities. For a group of larger projects, however, the effective use of the land increased further, due to more net lettable area obtained with larger tower footprints and podiums with deeper office space. [See Appendix F, table F.4]

By the mid-1980s, Melbourne had a new comprehensive system of urban design controls, a new structure of governance for planning approvals in the hands of the State Minister of Planning and a state-wide regulatory framework for building practice in the process of transitioning from the prescriptive model of the UBR to a new performance-based code. These controls affected and restrained the form of the city and the form of the individual buildings alike. Urban design controls promoted a volumetric reinstatement of the historic streetscapes that the city had annihilated, in part, during the 1960s and the 1970s. These controls explicitly sought to control the aesthetics of the city's skyline. Controls affected built volumes and surfaces and were considered necessary to safeguard the comfort of pedestrians from wind velocity excursions. These controls allowed a large level of discretion to planning authorities and their advisors to influence how the new landmark buildings of the city should appear. Tall office buildings, as the dominant building typology of the time, thus became the vehicle with which to test a new ethos about architectural aesthetics – and also a terrain of confrontation between designers and planning authorities on what architectural vocabulary should be more or less suited for Melbourne.

Tall office buildings of the time responded to new urban controls with built-form trends that eroded the facades of the purist shafts of the 1960s and 1970s. New skyscrapers continued to be taller and larger than their predecessors. Most frequently, the new model was able to provide an overall area of approximately 60,000 square metres of net lettable area in a single building. In the tallest examples, floor plates became larger, while growing building height translated into more lift groups – typically four – to be accommodated

within service cores of a larger footprint. The building envelope was articulated to break down the monolithic geometry of perfect squares or short rectangles of the previous decades. The new generation of buildings had re-entrants, buttresses, setbacks and box-breaking re-entrants. In countertendency with the wind-efficient 45 degree rotations of several precedents of the 1970s, and despite some notable exceptions (Rialto and Melbourne Central), most skyscrapers of the late 1980s reverted to frontages aligned with the city grid. The height of the towers was enforced *de facto* to prevent overshadowing of the Yarra River with the bulk of towers and flat tops were visually banned and superseded – or disguised - by lattice towers, spires, stepped parapets and sloped roofs.

Notwithstanding the articulation of the building envelopes and exception made for 333 Collins Street, the Big Six were a point of further typological evolution of the model of the centre core square tower of the 1970s. But as a result of the large oversupply created by uncontrolled speculation, these tall office buildings were also a point of no return. In the history of Melbourne's skyscrapers, the Big Six were also the signal of a typological extinction attested by the lack of completion of similar projects from the end of the 1990s until the beginning of the twenty-first century.

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Chapter 6

The five material elements of Austerica (1955-1995)

Air, aluminium, glass, steel and concrete technologies in Melbourne's tall office buildings

It is inevitable that Australia should be drawn deep into the aura of American influence in this second half of the American century. However, there is a difference between being stimulated by ideas from another country and copying the detailed shape of its thinking, habits and fashions. The former is normal cultural exchange, and America makes no bones about being in this market. She absorbs ideas from outside with avidity, but she changes and develops them. Australia's method of copying America, on the contrary, is in the second category: the Chinese copy, the parrot's imitation, the little boy mimicking his big brother's actions without fully understanding what he is doing.

Robin Boyd, 1960¹

The question of American influence in Australian architecture was a recurrent object of interest and debate in the twentieth century. Robin Boyd, referring to an allegedly Australian trend to absorb foreign inputs without re-elaboration, was perhaps ahead of his time to conjecture upon the presence of a cultural sub-identity suspended between Australia and America. In 1960, when Boyd denounced the aesthetic dangers that could descend from such an imaginary middle-place, which he named "Austerica",² the skyline of Melbourne was already changing. But the city was, at large, still unaffected by the radical transformations that were about to be brought by tall building developments.

By the mid-1970s, and including a coda in the 1980s, American influences in Melbourne's architecture could not be ascribed to a local phenomenon of stylistic mimicry, as American designers contributed directly to design a handful of important tall buildings that changed the skyline of the city. In 1975, when the works of American-influenced landmarks such as Shell Corner, AMP Square and BHP House were complete, and while the large construction site of Collins Place made slow progress hindered by disputes and difficult economic conditions, the debate on Australian Americanism was reinvigorated in

¹ Robin Boyd, *The Australian Ugliness* (Ringwood, VIC: Penguin, 1980), 64.

² Boyd, *The Australian Ugliness*, 63-66.

Melbourne by Howard Tanner, who formulated a critique of the “antipodean versions of the American skyscraper” in *Architecture in Australia*.³

Tanner made his point reiterating first of all a few critical stances of American origin. His references included Arthur Drexler’s reservations about the urban impact of the John Hancock Center in Chicago, lengthy quotes against modernist office towers from Charles Jencks’ *Modern Movements in Architecture*,⁴ and due reference to Jane Jacob’s *Death and Life of Great American Cities*⁵ and Henry Miller’s novel *The Air Conditioned Nightmare*.⁶ Using Shell Corner, AMP Square, Eagle House and BHP House as case studies, and giving account particularly on the effect of these buildings to their surrounding streetscapes, Tanner advanced a critique against the urban impact of American-made and influenced commercial architecture in Melbourne. The timeliness of Tanner’s remarks about the urban impact of tall buildings should not surprise, as his position converged with a widespread cultural shift, which – as discussed in the previous chapter - informed the birth of a new regulatory environment and the rise of a new aesthetic sensibility in Melbourne.

The second foothold of Tanner’s critique was less predictable. A negative accent was placed on the “machine technology” that generated “simplistic architecture of structural forcefulness”.⁷ But in conclusion, albeit conceding recognition of the aesthetic elegance and some notable technological advancement of the individual buildings, Tanner’s argument was in line with Jencks’s post-modern invectives, which indicated that the “American skyscraper” was the sign of a professional trend that made “confusion between social ideals and the combination of glass, metal and bureaucracy”.⁸ In this line of thought, the architectural culprit was “Bunshaft’s philosophy” of office design, for which the “aspect of the worker being foremost in the designer’s mind [had to] be questioned.” Bunshaft’s formula was this: “glass and metal curtain wall + column free office space + air conditioning = the maximum potential office block package”.⁹

³ Howard Tanner, “Glazed Idylls/Idols?” *Architecture in Australia* 64, no. 4 (August 1975): 77-85.

⁴ Charles Jencks, *Modern Movements in Architecture* (Garden City, NY: Anchor Press, 1973).

⁵ Jane Jacobs, *The Death and Life of Great American Cities* (London: Jonathon Cape, 1962).

⁶ Henry Miller, *The Air-conditioned Nightmare* (New York: New Directions, 1970).

⁷ Tanner, “Glazed Idylls/Idols?”, 77.

⁸ Tanner, 77.

⁹ Tanner, 78.

Keeping in mind the existence of this form of antagonism towards American influences, it is therefore pertinent to see how these foreign inputs took material form in Melbourne's tall office buildings or, as put by Tanner, through the simplistic application of air conditioning, "glass and metal" and "column free office space". Leaving aside possible inputs of architectural form, space quality and style, which will be considered in chapter 8, the discussion should proceed first from the material elements of "Bunshaft's philosophy". Namely, these material elements should consider a technological context in Australia, where after WWII considerable knowledge transfer and innovation occurred in the fields of air conditioning systems and light-weight façades of glass and aluminium, and where a significant process of technological evolution affected the construction methods of steel and concrete, the two materials that are preponderant and vital for high-rise structures.

6.1 From constant to variable volume

The evolution of comfort air conditioning

Air conditioning for comfort and PSALI

In Australia, air conditioning expertise developed first as an off-spring of a strong local sector of industrial refrigeration; but since the 1920s - and at least until the 1970s - the mechanical building services industry grew with close ties with leading American manufacturers of heating ventilation and air conditioning systems. The Australian Institute of Refrigeration Air Conditioning and Heating (AIRAH) was formed in 1920;¹⁰ following trends set in America, the first applications of air conditioning – for other than farming or industrial purpose – were experimented with single duct systems in large undivided spaces, such as auditoriums, theatre halls and department stores. One of the earliest buildings to be air conditioned in Australia was the Prince Edward Theatre in Sydney in 1926, followed three years later by the Regent Theatre in Brisbane.¹¹ One early application of air conditioning in Melbourne was at the Hotel Australia, where the theatres and bars located

¹⁰ W.R. Ahern, "Fifty Years of Comfort Air Conditioning," *Australian Refrigeration, Air Conditioning and Heating* 24, no. 6 (June 1970): 30-32.

¹¹ Ahern, 30.

in the basement were artificially cooled with a system known as “inverted thermal storage”.¹²

We cool people.
All people. Big ones, small ones,
old and young ones.
In shops, schools, offices, factories,
hotels, restaurants, banks.
All places.
Better.

Pope
Product of Simpson Pope

cool it!

EMAIL

Figure 6.1

Promotion of air conditioning services from one Australian manufacturer and sub-contractor, 1970

During the 1930s and 1940s, new developments began with dual duct systems, which had constant volume and variable temperature control and were applicable for multiple rooms, and hence suitable for office buildings. These advancements came from pioneering work done in America by Carrier and Cherne, and knowledge of this progress reached Australia before WWII.¹³ In Melbourne, air conditioning for office buildings was used possibly for the first time in 1939, at the lower three floors of the E.S.&A. Bank in Melbourne, in a building designed by Stephenson and Turner and located at the corner of Elizabeth and Collins Street.¹⁴

¹² “Hotel Australia, Collins Street,” *Journal of the Royal Victorian Institute of Architects* 37, no. 7 (September 1939): 191-201; quoted in Miles Lewis, *Melbourne: the City’s History and Development* (Melbourne: City of Melbourne, 1995), 119-120.

¹³ Ahern, “Fifty Years of Comfort Air Conditioning,” 31.

¹⁴ SLV, Stephenson and Turner Archives, vol. 3279, CML-1-2B, 1958, Stephenson and Turner Architects, letter to E.W. Curtis: “Proposed New Building Air Conditioning,” 25 September 1958.

Before and soon after World War II, the Australian industry consisted mainly of local manufacturers of equipment working under licence from American companies.¹⁵ Thereafter, the Australian business of air conditioning rose almost fourfold between 1948 and 1958, and a network of distributors and installers prospered as sub-contractors of large projects particularly in Victoria and New South Wales.¹⁶

In the same years, following technical progress and trends established in the USA, fluorescent lighting technology was rapidly adopted in Australia as the ideal and complementary building service technology of air conditioning. In 1952, an Australian electrical engineer delivered a lecture at the Illuminating Engineering Society of Australia in New South Wales, and expounded the technical limitations of “good old” tungsten lamps in the context of an emerging changeover to cooler fluorescent tubes, which threatened to bring to an end the use of heat-generating incandescent lamps.¹⁷

The Mazda lamps, designed and produced in America by Matthew Luckiesh for General Electric were among the first fluorescent cool light fittings to be commercialised in Australia.¹⁸ Post-war ceiling systems were designed for full integration with air conditioning services and continued to evolve during the 1960,¹⁹ and know-how and products continued to be resourced and imported from the USA during the 1970s.²⁰ Fluorescent lamps in workspaces were designed and advertised to improve employee efficiency by reducing reading fatigue. In the late 1950s, from the pages of *Architecture and Arts*,²¹ an Australian architect of the State Electricity Commission of Victoria referred to studies done by Matthew Luckiesh, which connected improved productivity with higher levels of illumination. Technical advancements in permanent supplementary artificial lighting of interiors (PSALI) progressed in parallel with the awareness of the positive

¹⁵ J.J.W. Siganto, “Golden Years in Australian Air Conditioning,” *Australian Refrigeration, Air Conditioning and Heating* 22, no. 10 (October 1968): 22-23.

¹⁶ Siganto, 22.

¹⁷ A. Dresler, “Has the Incandescent Lamp Reached the End of Its Development?” *Building, Lighting and Engineering*, 24 March 1952, pp. 52-53, 55.

¹⁸ Matthew Luckiesh was director of the Lighting Research Laboratory at General Electric in Cleveland, Ohio. Source: <<http://home.frognet.net/~ejcov/luckiesh.html>> (accessed 10 October 2015).

¹⁹ “Essential Overhead,” *Architecture Today* 9, no. 8 (June 1967): 29-33 and no. 9 (July 1967): 39-42.

²⁰ Yvonne von Hartel, interview, 19 November 2013.

²¹ Kenneth R. Green, “Enlightened Interiors: a Report on Electricity,” *Architecture and Arts* 72 (October 1959): 50-53.

effects of lighting for office workers, and these developments converged into normative practice in Australia by the end of the 1950s.²²

For comfort and efficiency

In 1958, ICIANZ House [map 9A, 06] demonstrated in Melbourne the workspace quality revolution brought by air conditioning and PSALI in tall buildings. The tower was fully sealed and serviced by a Barber-Colman dual-duct distribution system interspersed among fluorescent light fittings in the ceiling. The system was divided into two zones. One zone was within reach of natural light, 12 feet deep from the perimeter line of heat-absorbing single glass; the other was a central PSALI zone controlled with air conditioning with less demanding cooling loads.²³

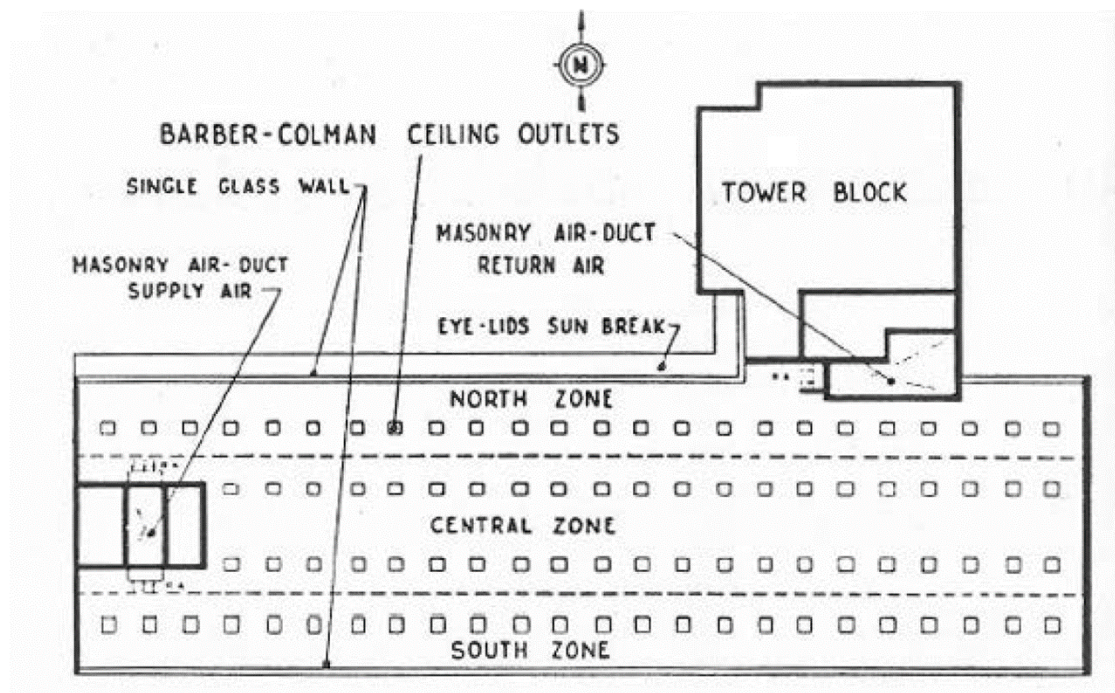


Figure 6.2
ICIANZ House; schematics of zoned air conditioning at typical floor, 1959

²² Green, 51.

²³ John D. Targett, "Air Conditioning Australia's Tallest Building," *The Refrigeration Journal* 12, no. 8, (March 1959): 12-19.



. . . always perfect weather

The forecast is always the same inside I.C.I. House, Melbourne, no matter if there's hail, rain, frost or scorching sun outside. Staff and management in the new ICIANZ headquarters will now spend one-third of their lives in conditions of ideal comfort – for better health, better work . . . endless fresh air brought to perfection of temperature and humidity by expert climate engineers. The Australian company that achieved this is Frigrite Limited, which supplied air conditioning for I.C.I. House, using Barber Colman outlets and grills for engineered air conditioning; and also made and installed all refrigeration for the skyscraper. (And, just for the record, Frigrite are now Australia's sole suppliers of the great WORTHINGTON air conditioning equipment. That's worth remembering).

FRIGRITE LIMITED *Graham St. West, Port Melbourne. MJ 2631 and Sydney, Brisbane, Adelaide, Perth.*

Figure 6.3

ICIANZ House; advertising by air conditioning sub-contractor in *Architecture Today*, 1958

Initially, the benefits of air conditioning in Melbourne were taken with doubtful considerations and caution, which arose from matters of technical reliability. In the late 1950s, the question on whether 'full' air conditioning was a matter of necessity in office

buildings was still debated by clients, architects and engineers, even for the most prestigious projects. This area of concern and reservation among clients can be ascertained by the vicissitudes of the Colonial Mutual Life (CML) Building in Collins Street [map 6B, 17].

In 1958, during the early stages of design, architects Stephenson and Turner had to give thorough explanations to convince CML to include air-conditioning in what was envisaged to be a first-class owner-occupied building in Collins Street.²⁴ Stephenson and Turner argued that the “prime reason for installing air conditioning [was] for staff comfort and efficiency”.²⁵ This stance was motivated by a cost benefit analysis expressing air conditioning cost as a percentage of the total salaries of the occupants. For a full air-conditioned building of the late 1950s, Stephenson and Turner indicated a high-velocity dual duct system to be equivalent to 2.7% of the cost of salaries. By comparison, an unconditioned system of heating and air ventilation had cost equivalent to 1% of salaries. The cost premium required by air conditioning was justified by steady year-round comfort for employees, which in turn would increase the productivity of the company.²⁶

It is difficult to forecast conditions within a building for a given set of outside weather conditions but, in our opinion, whenever the outside temperature exceeds 90° [32° Celsius] personnel efficiency is considerably affected. On the average this happens in Melbourne 25 days per year.²⁷

Additionally, the architects remarked that the CML Building was designed to last “for a long time”, and if built without air-conditioning it could be “considered sub-standard” in the short term.²⁸ Stephenson and Turner reinforced their argument with a survey of recently designed or completed “first class” office buildings equipped with air conditioning in Melbourne: the headquarters of Electrolytic Zinc, ICIANZ, Humes, Norwich Union, Alliance Assurance, ANZ Bank, Consolidated Zinc and Shell.²⁹

To this group of buildings contrasted the headquarters of HC Sleigh - completed in 1955 and antecedent of the later fully sealed HC Sleigh Corner - and the low-cost speculative

²⁴ SLV, Stephenson and Turner, “Proposed New Building Air Conditioning”, 25 February 1958.

²⁵ SLV, Stephenson and Turner, 1.

²⁶ SLV, Stephenson and Turner, 1

²⁷ SLV, Stephenson and Turner, 2.

²⁸ SLV, Stephenson and Turner, 2

²⁹ SLV, Stephenson and Turner, 2

Prudential Life Building in Queen Street [map 6B, 13].³⁰ The Building of HC Sleigh had a generous single glazed façade facing west and, being without air conditioning, it was known to have severe problems of discomfort in summer. Stephenson and Turner warned their client that a “greater need” of environmental control was required for buildings of modern construction, which followed a “lighter” trend “with a much higher ratio of window to wall”.³¹

Prestige and new technologies

In response to these seemingly compelling explanations, the representative of the Colonial Mutual Life Society responded with a note of further concerns.³² The economic feasibility of full air conditioning was questioned with two counter arguments underscored as “known facts”: (1) air conditioning was expensive to run, “if not prohibitive”; (2) methods of installation and operation were not fully understood in Australia, making the systems “not [...] reliable and trouble-free as they should be”.³³ To these points the client added three “reasonable assumptions”: (1) that air conditioning was not “necessary” in the temperate climate of Melbourne; (2) that it was not “universally acceptable” among staff and tenants of office buildings alike; (3) and that, despite problems, air conditioning seemed likely to be adopted widely in Australia and in Melbourne in the years to come.³⁴ In this discussion, the Society questioned design efficiency in a more holistic sense:

Can the building be so designed that the worst of the summer heat is excluded? (This refers to wall thicknesses, glass areas, and the provision of venetian blinds, louvres and other shades to windows.) Would not such a building make air-conditioning less expensive to operate if and when it were eventually added?³⁵

The representative of CML carried out independent enquiries with building owners and occupants of modern office building equipped with air conditioning, which revealed concerns shared by office building owners. The Alliance Assurance Building was known to have “serious technical difficulties” since its completion; the Hume Building was reported to be “most troublesome and unreliable”; the ANZ Building experienced

³⁰ “New Head Office for H.C. Sleigh Limited,” *Architecture and Arts* 27 (November 1955): 33.

³¹ SLV, Stephenson and Turner Archives, Vol. 3279, CML-1-2B, 1958, E. W. Curtis [Colonial Mutual Life Society], “Notes on air-conditioning”, memorandum addressed to Stephenson and Turner Architects, n.d. [March-September 1958].

³² SLV, E.W. Curtis [CML].

³³ SLV, E.W. Curtis [CML].

³⁴ SLV, E.W. Curtis [CML].

³⁵ SLV, E.W. Curtis [CML].

difficulties of “balancing temperatures” between different zones; the owner of the CRA Building in Collins Street confirmed lack of local know-how on air-conditioning systems, to which the corporation responded with the engagement of “overseas consultants”.³⁶

Stephenson and Turner replied confirming their initial recommendation and convincing, in the end, CML to include full air conditioning in the building. The justification for air conditioning was summarised in light of: trends towards lighter building construction with “less thermal insulation” and larger glass areas; trends to incorporate air conditioning to improve the prestige of premises and future letting prospects. To these reasons, the architect reiterated several economic benefits: increased human efficiency and performance in “daily tasks”; reduced personnel turnover; ability to “compete better for personnel due to improved environmental conditions”; opportunity to offset initial costs with owning and operating costs of the system; value of “increased comfort” affecting employees; reduced cleaning cost for “preservation of interiors and supplies”; building construction benefits arising from “increased flexibility due to air conditioning”.³⁷

Stephenson and Turner explained that the high degree of failures, which seemed to have occurred in Melbourne at that time, derived chiefly from buildings designed with “large glass areas”. But recent technical advancements from America promised to minimise these negative effects:

(...) the same trouble was experienced in U.S.A. some years back and has resulted there in a great deal of variation in air conditioning practice for this type of building. One particular variation has been the practice of lessening this effect by blowing conditioned air directly on to the hot glass and blinds. (...) This new technique is greatly facilitated by the use of high velocity air conditioning units using below window diffuser boxes. The advent of the “all air” type double duct high velocity installation which we are proposing for this building is a particular development of this technique which is only now becoming fully recognised in U.S.A. It has not been possible in the past to purchase this type of equipment in Australia, we are in a position however to assure you that we are now fully aware of these latest developments and have access to the very best overseas opinion which we will undoubtedly use in this case.³⁸

³⁶ SLV, E. W. Curtis [CML].

³⁷ SLV, E. W. Curtis [CML].

³⁸ SLV, E. W. Curtis [CML].



Figure 6.4

Colonial Mutual Life Building; internal view of the board room with under window induction units, 1963

High velocity

By the mid-1960s, air conditioning was deemed necessary for new office buildings to retain employees and attract prestigious tenants. Research done on the benefits of air conditioning on employee efficiency, was carried out and promoted as a selling point by air conditioning manufacturers.³⁹ Results of an American study were divulged by Pope, an Australian manufacturer and installer of mechanical services, which claimed that the efficiency of white collar work was indeed affected positively by the introduction of air conditioning.⁴⁰ The study showed a comparison of two employee samples, one operating in air conditioned space, and one in space only subject to natural ventilation. Tests

³⁹ "Does Air Conditioning Increase Employee Efficiency?" *Architecture and Arts* 13, no. 3 (March 1965): 57-58.

⁴⁰ "Does Air Conditioning Increase Employee Efficiency?", 57-58.

concluded that air conditioning, among a range of wider benefits, improved productivity and decreased absenteeism. The same study indicated that a daily reduction of seven minutes of down-time per employee was enough to repay the initial cost of the system.⁴¹

Knowledge of high velocity air conditioning reached Australian designers from American sources. In 1956, the journal *Architecture and Arts* disseminated the techno-economic implications of this new system.⁴² High velocity air conditioning was beneficial in particular for large and expensive projects, and ideal for tall office buildings, where smaller duct sizes could lower floor to floor height in the order of 8 to 10 inches. High-velocity distribution reduced cost and enabled increasing returns with more floor accommodation. In comparison with older systems, vertical shafts could be reduced in area by a quarter.⁴³

Once client reservations were overcome, high-velocity dual ducts applications grew steadily in Australia. The first application of high-velocity dual duct air conditioning was completed in Melbourne in 1960, in the headquarters of Shell designed by Skidmore Owings Merrill (SOM) at the corner of Bourke and William Streets [map 1D, 12].⁴⁴

Besides reduction of duct sizes, the success of high-velocity air conditioning was due to the effectiveness in the control of temperature at the perimeter of the building. Typically, dual duct distribution was used in combination with under-window induction units. Dual – also known as double - duct systems distributed air from a central plant with two parallel ducts, one containing cold air and the other hot air. In combination with high-pressure distribution, dual duct air was fed to induction units along the façade, which, by blowing air on heat-absorbing single-glazing, were able to respond more effectively to changing

⁴¹ “Does Air Conditioning Increase Employee Efficiency?”, 58.

⁴² “High Velocity Air Conditioning,” *Architecture and Arts*, no. 35 (September 1956): 35-38. The article was based on a talk given by John Everetts at the American Society of Heating and Air Conditioning. Some illustrations contained in the Australian article are identical to those contained in C. Milton Wilson, “High-velocity Air Conditioning: Its Effect on Building Design,” *Architectural Record* 119, no. 5 (May 1956): 227-231.

⁴³ “High Velocity Air Conditioning,” *Architecture and Arts*: 35.

⁴⁴ “Office Building,” *Architecture and Arts*, no. 50 (December 1957): 22.

conditions at the perimeter of the building. With induction units controlled by a thermostat, this degree of differentiation could be fine-tuned even on an individual room basis.⁴⁵

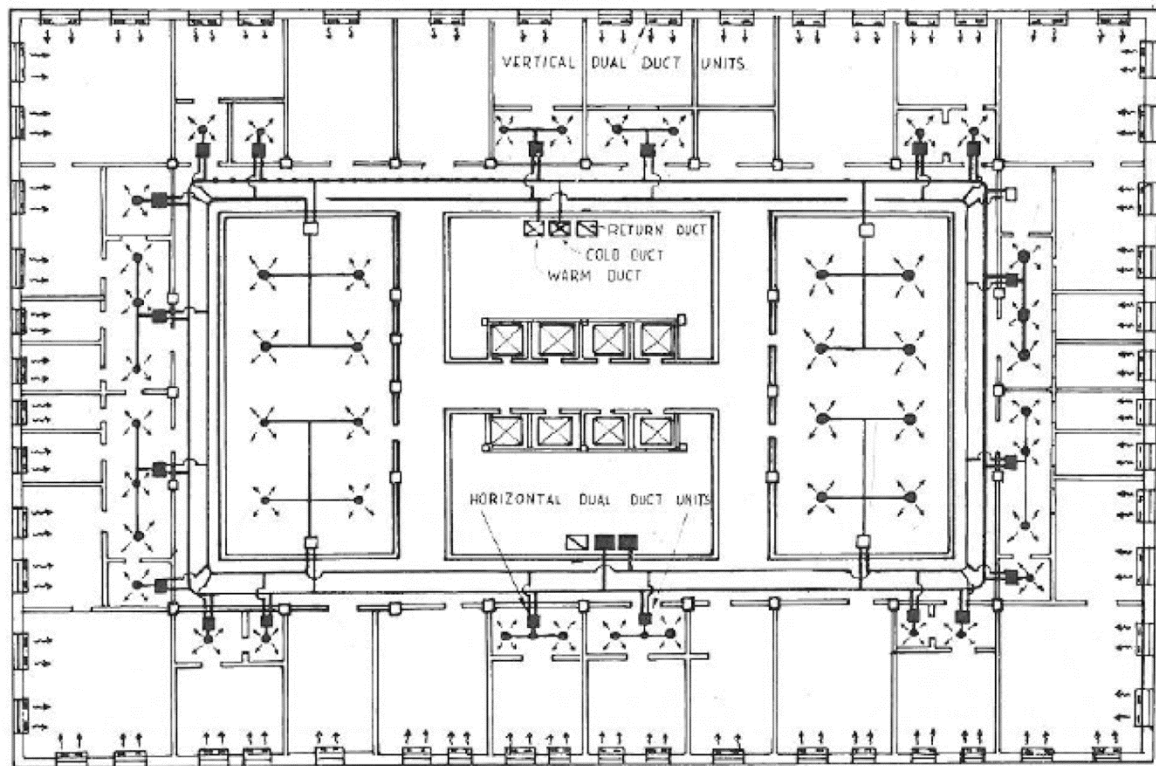


Figure 6.5

Typical air conditioning zoned layout in a generic centre core office building with dual duct system (serving inner rooms) in combination with induction units (serving perimeter rooms), 1959

Perimeter control

The pairing of dual duct air with induction units was common in the 1960s and applied in Melbourne tall office buildings; used at first with the Shell Corner Building, it was soon after adopted in other projects, for example in the tower of the State Government Offices in MacArthur Street [map 9B, 36],⁴⁶ and in the other SOM-designed tall office building of the 1960s, AMP Square [map 5B, 37].

⁴⁵ A. P. Disney, "High Velocity Distribution and Perimeter Cooling," *Refrigeration Journal* 12, no. 7 (January 1959): 13-18.

⁴⁶ "State Government Offices," *Architecture in Australia* 59, no. 4 (August 1970): 644.

At AMP Square, air conditioning services were so integrated with the building envelope that they affected the overall architectural expression of the tower. From inception, the primary cooling plant was designed to be located on top of the tower, thus taking advantage of height to minimise problems of mist, smoke staining and corrosion. Conversely, areas requiring “special” attention for air conditioning, such as computer room, auditorium, cafeteria and kitchen below-ground, were located underground in a PSALI environment immune from variable heat loads that could arise from exposure to sun light.⁴⁷

Air conditioning was designed by the mechanical engineers of Bates, Smart & McCutcheon (BSM) and developed in close collaboration with the design team of SOM in San Francisco, which, according to the mechanical team of BSM, approached the project “prepared to meet the genuine requirements of engineering services.”⁴⁸ SOM set nonetheless a considerable challenge for the local engineers by requesting the omission of any visible presence in the façade of air intake grilles. As a result, all primary plant and air-intake was located on the roof terrace, where grillage was concealed behind the parapet drawing all air required to service 25 floors above ground of the building.

A total of 1,148 dual duct induction units, with a capacity to condition a zone of 10 feet deep from the envelope, were installed in the tower. Perimeter ductwork was integrated in the façade, resulting in a V-shaped configuration of precast panels interspersed by window bays of bronze heat-absorbing single glazing. The units were fed by droppers at 30 feet intervals in a hit and miss configuration staggered from the structural grid. A high degree of internal flexibility was made possible by integrating services with the 5 feet partition grid. Induction units were located at 10 feet intervals, and if required, some units could be temporarily disconnected to allow for the installation of intermediate partitions.⁴⁹ Return air was reticulated internally through the ceiling via slots in the surrounds of light fittings,

⁴⁷ Brendan J. Byrnes, “St James Square: Air Conditioning a Big Melbourne Office Complex,” *Australian Refrigeration, Air Conditioning and Heating* 25, no. 2 (February 1971): 18-24 and no. 3 (March 1971): 14-17.

⁴⁸ Byrnes, (February 1971): 19.

⁴⁹ Byrnes, (March 1971): 14.

which were developed specifically for the project together with a customised acoustic ceiling grid of gypsum plaster tiles.⁵⁰

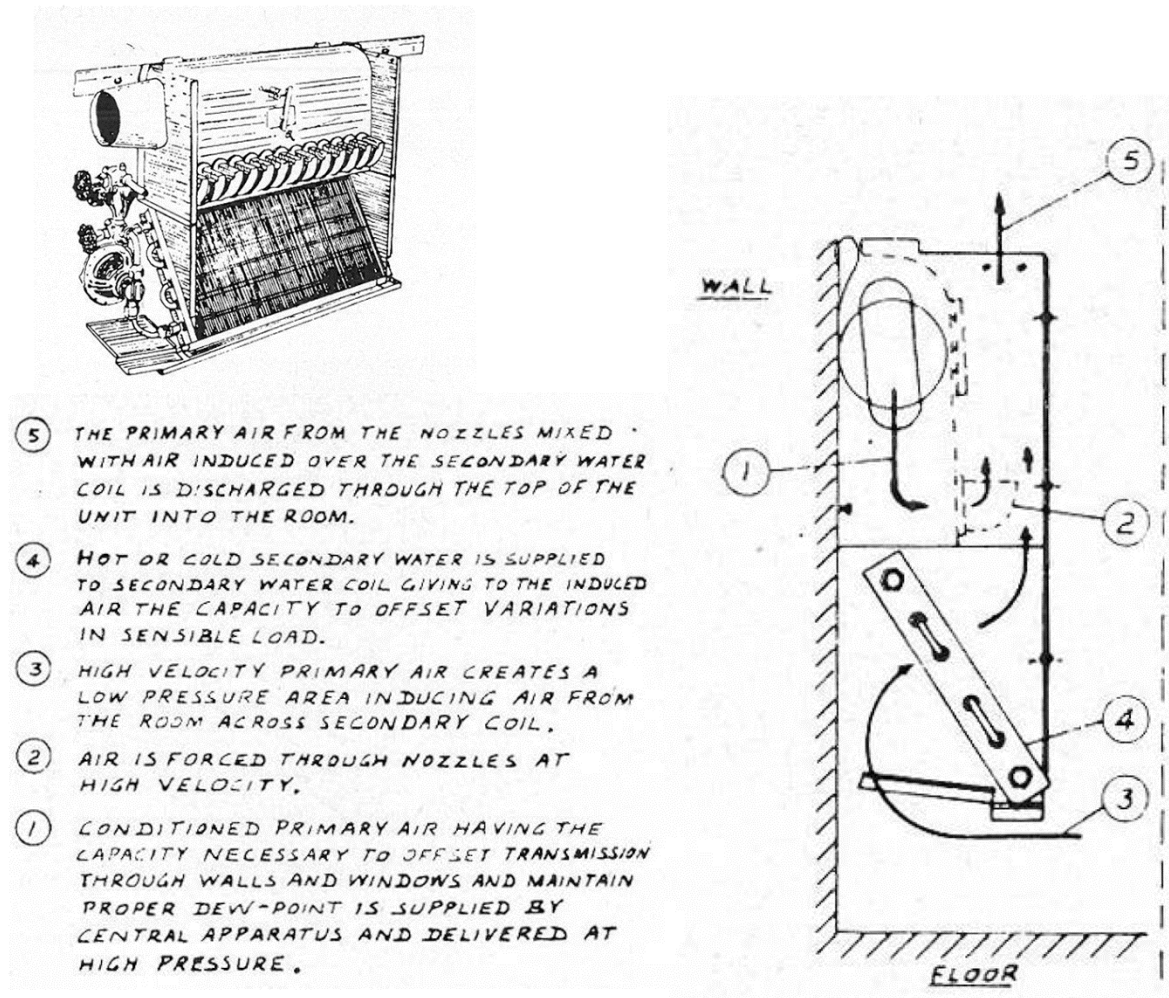


Figure 6.6

Schematics and description of under-window perimeter induction units

Some features of the system aimed at minimising energy use. A reheat high-velocity system was used for the internal zone and an “economizer” cooling method was used for the perimeter induction units, which made use of “free cooling” during winter time. This method eliminated secondary gas-chilled water supply and replaced it with cold air drawn directly from outside. The primary cooling system was powered by diesel oil, but if required, it was predisposed for a future conversion to gas-firing. When completed in 1969,

⁵⁰ “A.M.P. Square Ceiling,” *Architecture Today* 12, no. 2-3 (December-January 1969-70): 19-20.

AMP Square showcased in Melbourne a paradigmatic use of constant volume perimeter induction combined with high-velocity dual duct and reheat for interior zones. But soon after, following a contingent need for even further efficiency in energy use, a new generation of air conditioning systems and components reached Australia from America.

Variable air volume

Among these advancements, strategic progress was made with variable air volume (VAV) systems, which became critical during the 1970s, in response to rising energy costs. Following the development of new ceiling mounted mixing box products, these systems began to be distributed in Australia by Carrier and others from the late 1960s.⁵¹ VAV systems were developed in the 1940s and 1950s, but unsuccessful results were experienced due to the difficulty of holding steady air supply volumes for long periods of time. The rediscovery of VAV in the second half of the 1960s followed marked improvements in reliability given by air flow regulators, slot diffusers and fan controlling devices.⁵²

VAV systems differed from the main systems of the previous generation – e.g. dual duct and terminal reheat systems - for supplying air at the terminals with constant temperature, and for changing air volume in response to changes of cooling loads. By contrast, older systems supplied air through terminals at constant volume and with variable temperature in response to variable loads. The most tangible benefits of VAV were flexibility and energy efficiency in the response to drastic changes of cooling load, which translated into considerable savings in operation. Moreover, VAV systems relied mostly on ceiling distribution systems, which were apt for open-space landscape planning and eliminated under-window induction units, thus saving precious space at the perimeter of the building.

Before the introduction of VAV, air conditioning with constant air volume had to be sized to respond to a nominal ‘peak’ load, which represented the sum of maximum cooling load conditions of each space in the building. VAV systems could be sized instead according to ‘block’ cooling loads, which represented the instantaneous load at a given “design peak day”.⁵³ Block cooling loads were significantly lower than the peak loads, while the

⁵¹ K. B. Terry, “Variable Volume Air Conditioning Systems and Devices,” *Australian Refrigeration, Air Conditioning and Heating* 23 (October 1969): 34-38, 47-48.

⁵² Norman F. Steketee, “Variable Volume Air Conditioning Systems,” *Australian Refrigeration, Air Conditioning and Heating* 26, no. 1 (January 1972): 39-43.

⁵³ Steketee, 40.

adoption of the latter necessitated systems to be over-sized for reliable operation. A study done by the American air conditioning manufacturer Trane showed a comparison of VAV systems with constant volume dual duct and terminal reheat systems: variable volume supply could give savings of first cost from 5% to 20% and savings in operation from 30% to 55%.⁵⁴

Carrier Moduline: the way to please an eternal triangle.

private offices with standard partitions. The entire interior of this high-rise building is served by a single duct Carrier Moduline System, with close temperature control in both enclosed and open spaces. Without forsaking modular control, or moving the Moduline units, all partitions can easily be relocated if and when required.

1. Architect
Now! No longer must ceiling design cater to air conditioning. New Carrier Moduline Weathermasters meet the challenge of every modern high-rise building.

3. Tenant
Now! No longer must one tenant be comfortable at the expense of another. Carrier's unique Variable Volume automatically adjusts—even when more lights are turned on, or more people move into a room. New Carrier Moduline Systems have benefits far too numerous to detail here. So, before you move in high-rise design or installation, mail the coupon for complete details. And let Carrier prove to you that you can please all of the people, all of the time!

2. Owner
Now! No longer must changes in tenant space requirements cause owners costly alterations in air conditioning systems. Not with new Carrier Moduline Systems. Once installed they're there to stay.

37AD Dual Moduline

This side variable volume constant temperature (secondary air) COLD year round (takes care of variables solar, lights, people)

This side constant volume variable temperature (primary air) HOT in Winter COLD in Summer (takes care of transmission losses or gains)

The perfect answer to the perimeter zone... the dual conduit system

The latest in the State of the Art on Systems **Carrier**

Figure 6.7

Promotional insert of ceiling-mounted Variable Air Volume product by Carrier in Australia, 1973

In the late 1960s, an Australian manager of Trane with previous experience in California reported that, in Los Angeles, the growth of VAV systems was “phenomenal” and expanding from a marginal usage in 1965 to “at least 50% of office buildings” of the city designed to consider the inclusion of variable air volume devices.⁵⁵

In Australia, VAV replaced progressively perimeter induction and constant volume supply systems, until becoming normal practice in the city during the 1980s. A VAV conditioning system was developed by Trane Australia and installed throughout the typical floors of Rialto [map 5D, 64];⁵⁶ ceiling distributed systems using variable volume terminals were

⁵⁴ Steketee, 41.

⁵⁵ Steketee, 39.

⁵⁶ Lindsay St Leon, “The Rialto Air Conditioning System,” *Building Product News*, (August 1985): 22.

commonly used in the “Big Six” family of skyscrapers, where VAV was a main feature of environmental control, for example, at 120 Collins Street [map 8A, 69], at Bourke Place [map 1D, 68] and at Melbourne Central [map 3A, 66].⁵⁷

6.2 Pulling the envelope

The light-weight shift and the quest for thermal economics

Knowledge transfer

After World War II, besides the innovations brought by PSALI and air conditioning, the Australian construction industry was subject to a shift towards light-weight construction systems, which were used particularly in façades with large window areas.

In the post-war period, several technological transfers occurred from military to civil use,⁵⁸ and one of these pertained to a new material for construction: aluminium. Aluminium, due to its high strength to weight ratio, was largely employed for aircraft frames during WWII in America, Great Britain and Australia. Soon after the conflict, excess of military production prompted consideration of this lightweight metal for building applications as an alternative to steel. Early structural applications of aluminium included trusses, stud walls and pioneering examples of space frame construction.⁵⁹ But Aluminium’s excellent properties of workability made it particularly suitable for building envelopes.

In Australia, advanced know-how of aluminium fabrication spread initially during the war through the presence of industrial partners of American and British origin. American and British aircraft manufacturers made industrial agreements with the Commonwealth Aircraft Corporation (CAC), located at Fisherman’s Bend near Melbourne, and became instrumental for the diffusion of aluminium technology in Victoria. During the war, aluminium framing and panelling systems were imported and used extensively in Australia for the manufacturing under licence of American and British military aircrafts.⁶⁰ After the

⁵⁷ Peter Georgiev, “The Big Six Office Buildings,” *Architect* (August 1991): 12, 15 and 17.

⁵⁸ Philip Goad and Julie Willis, “Invention from War: a Circumstantial Modernism for Melbourne Architecture,” *Journal of Architecture* 8, no. 1 (Spring 2003): 41-62.

⁵⁹ “Aluminium for Building: Key Metal of the Twentieth Century Promises to Compete with Steel as a Basic Structural Material,” *Architectural Forum* 97, no. 12 (December 1952): 152-155.

⁶⁰ From the late 1930s, the aeronautical company of North American licenced CAC for the production of aluminium framed airplanes. The trainer Texan/Harvard model, renamed Wirraway in Australia, was built with aluminium frame. Other all-aluminium North American models built by CAC under licence were the P-

war, during steel rationing times, aluminium soon proved to be a versatile material with good potential to be explored beyond military aviation use. Some collateral uses were developed in Australia even during the war for the construction of bus panelling and prefabrication of hospital units.⁶¹

After the end of WWII, aluminium became the primary material for grid, or stick framed curtain walls in office buildings. In Melbourne, the potentials for architectural aluminium applications were exploited especially by OCAL, a subsidiary of the Overseas Corporation of Australia Limited.⁶² In the 1950s, this company supplied break-through façade systems including the one for ICIANZ House in Melbourne. At the earliest, given the relatively good anti-corrosive properties of the raw material, the metal was left untreated, or “mill finished”. Unprotected aluminium, for example, was used in the first curtain walls of the city, such as Hume House [map 1D, 05] and ICIANZ House.⁶³

Although relatively immune from mild atmospheric agents, durability concerns for lack of superficial protection remained due to issues of incompatibility with other primary materials, like steel and concrete. Anodic protective coatings were thereon introduced in Australia during the 1960s. An early application of anodising in large office building projects was used in the spandrels of Shell Corner in Melbourne in 1960, as a result of the familiarity and experience with the material of the American designers of the building.⁶⁴

In early curtain walls, technical challenges arose due to thermal movement and weather-tightness.⁶⁵ Early stick-built methods, such as the one used in Melbourne at Feltex House, relied on very simple traditional glazing techniques, where external tee bars were combined with internal glazing beads. This method allowed the installation of glass from

51 Mustang and, after the war, the F-86 Sabre.

<http://www.ctie.monash.edu.au/hargrave/MEGGS_CAC.html> [Accessed 25 September 2015].

⁶¹ Rico Bonaldi, interview, 1 September 2014.

⁶² The Overseas Corporation was established in 1945 by John Stanley Storey in joint venture with William Wasserman, the chief of the American Lend-Lease Mission in Australia. Overseas Corporation produced furniture, appliances and parts for aircraft. John Lack, s.v. “Storey, Sir John Stanley (1896-1955),” *Australian Dictionary of Biography* 16, (Melbourne: 2002); <<http://adb.anu.edu.au/biography/storey-sir-john-stanley-11783>> [accessed 30 September 2015].

⁶³ Rico Bonaldi, interview, 1 September 2014.

⁶⁴ “Sealed-in, Self-colouring Aluminium Alloys,” *Architecture Today* 6, no. 1 (November 1963): 29; Richard Foster, interview, 11 December 2013.

⁶⁵ E.R. Ballantyne, “The Weathering of Buildings, with Particular Reference to Curtain Walls,” *Architectural Science Review* 1, no. 1 (November 1958): 18-20.

inside, but left joints exposed to wind-driven water penetration. Curtain wall detailing was improved at ICIANZ House, where glass was installed from the outside by means of scaffolding. Glass was secured mechanically with an external channel fixed on a rebated frame; this configuration anticipated, by accident, the one of drained joints, which became common in aluminium extrusions of the late 1960s and 1970s.⁶⁶ Glazing from the outside posed, however, safety risks,⁶⁷ high costs and demand of highly-skilled abseilers to finish the envelope with the application of wet-sealants.⁶⁸

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Figure 6.8

Glazing sub-contractor advertising illustrative of glazing techniques used at ICIANZ House, 1958-60

By the mid-1960s, Australian designers acquired familiarity with this new light-weight and versatile metal. More durable aluminium finishes were developed and custom-design

⁶⁶ Rico Bonaldi, interview, 1 September 2014.

⁶⁷ Four casualties during the construction of ICIANZ House are mentioned in Gideon Haigh, "Melbourne's bold leap upwards: the inside story of Australia's first skyscraper," *The Guardian*, September 7, 2016. <<https://www.theguardian.com/cities/2016/sep/07/melbourne-australia-first-skyscraper-ici-orica-house>> [Accessed 9 September 2016]. Only one casualty is recorded officially for a rigger occupied in lowering a scaffold, who died falling from the 15th floor to the 8th floor. Public Record Office of Victoria, VPRS 1120, City of Melbourne Archives, Building Application File 30056, E. A. Watts to the City Building Surveyor, 23 October 1957.

⁶⁸ *Architecture Today* 1, no. 2 (December 1958): 59; *Architecture Today* 2, no. 2 (December-January 1959-60): 6.

opportunities became available for some commercial projects. At HC Sleigh corner, for example, Bates Smart & McCutcheon and OCAL developed a complete new suite of window extrusions that met the specific custom requirements of the project.⁶⁹



Figure 6.9

Newspaper advertising of Australian aluminium manufacturer, 1965 (left) and aluminium extrusion produced by Alcoa, Geelong, Victoria, 1973 (right)

In the 1970s, solid aluminium cladding systems gained further acceptance in Melbourne and were used extensively as solid spandrels or column covers in tall office buildings such as Eagle House [Map 6A, 46], Estates House [Map 6A, 51] and Collins Wales House [Map 6B, 59]. At Eagle House aluminium spandrels in combination with reflective glass were installed using - for the first time in the city – concrete-embedded “Unistrut” channels in lieu of masonry anchors.⁷⁰ The new system paved the way for a methodology of installation that allowed for better margins for error and flexibility of adjustment on site and it was destined to have far reaching consequences in façade construction. In the mid-1970s, one of the first applications in the city of aluminium cladding designed according to the self-draining principle of pressure equalisation was used by Godfrey and Spowers at

⁶⁹ “Special Aluminium Windows for New H. C. Sleigh Building,” *Architecture and Arts* 12, no. 6 (June 1964): 27.

⁷⁰ “Flexible System,” *Architecture Today* 13, no. 8 (September 1971): 15.

Collins Wales House, where it was developed in collaboration with local manufacturer and sub-contractor Dowell Aluminium. (See figure 6.10)

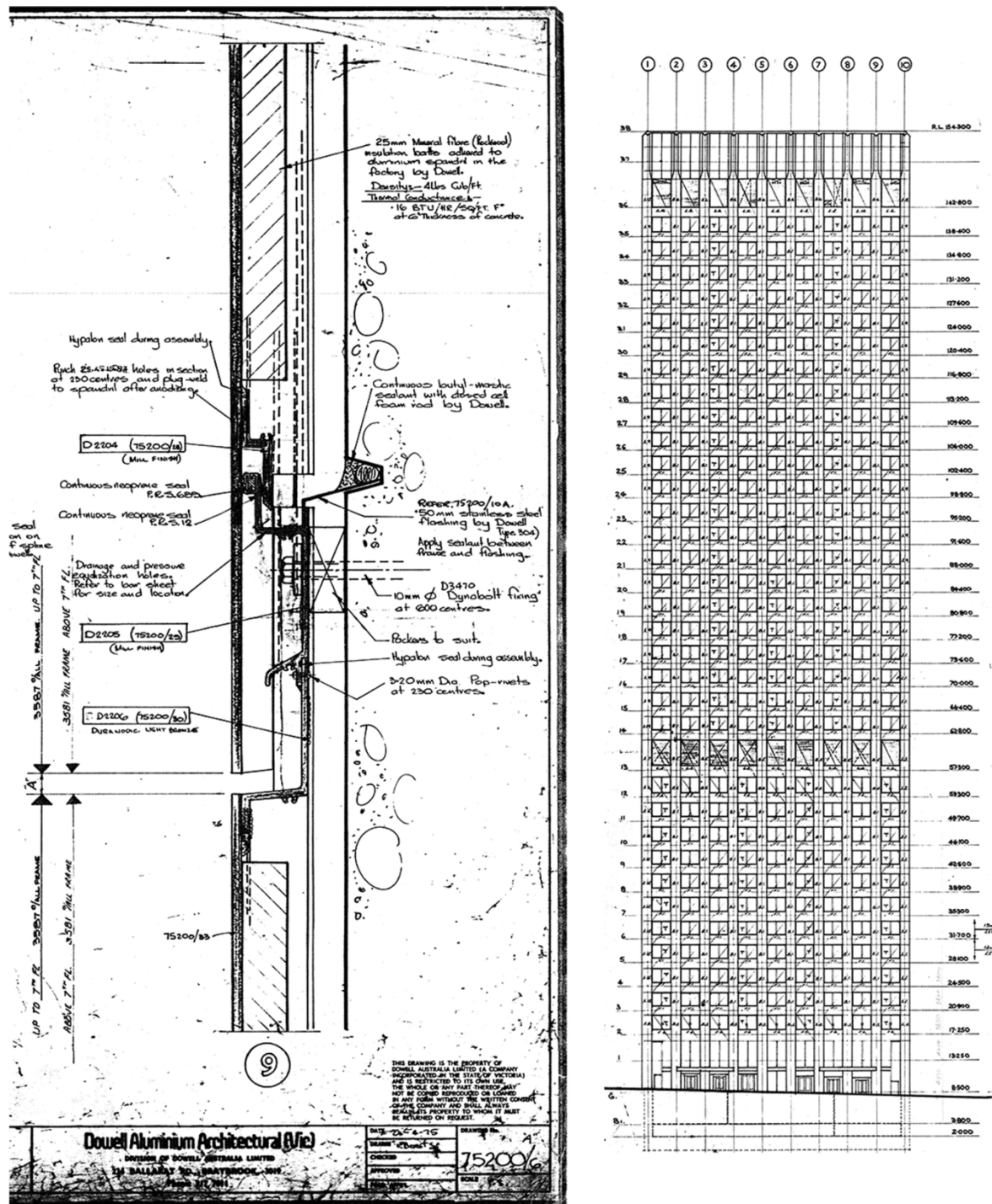


Figure 6.10
Collins Wales House, 360-374 Collins Street, 1974-78; construction detail of aluminium façade system incorporating pressure equalisation design principles and general arrangement of façade on Collins Street

Modern glass in Australia

The diffusion of aluminium was complementary of developments in production, distribution and performance of glass products. In the early 1950s, glass technology in Australia revolved around the manufacturing method of vertically drawn polished plate glass. A large share of the supply was imported from America, from Pittsburgh Plate Glass (PPG) Company and Libbey-Owens-Ford (LOF). PPG and LOF exercised considerable influence in Australia until the 1980s, supplied glass for milestone projects and distributed strategic innovations, such as heat-absorbing glass, double glazing and reflective glass.⁷¹

Glass was also produced in Australia by Australian Consolidated Industries Limited (ACI), which, under the subsidiary name Australian Window Glass (AWG), had supplied window glass nationally since the 1920s.⁷² After WWII, glass in Australia was also imported from European manufacturers such as Glaverbel (Belgium) and Pilkington (United Kingdom). From the early 1960s onwards, Pilkington exercised considerable influence in the Australian glass industry. In the 1960s, as a result of the successful development of float glass, Pilkington's products filtered gradually into the Australian market. In 1961, after receiving technical and financial assistance from the British manufacturer, ACI opened a plant in Dandenong, Victoria, and thereon Pilkington and ACI established a partnership that took to the production of float glass in Australia, which started at Dandenong, near Melbourne, in the early 1970s.⁷³

In the 1950s and 1960s, the most economic method of solar control was heat-absorbing glass, which reduced significantly heat gain from ultraviolet and infra-red rays. Heat-absorbing glass used in office buildings had a characteristic bluish, bronze or grey tint that did not compromise visible light transmission; solar energy was filtered through glass thickness and not by reflection, hence radiating heat outward and inward with almost equal

⁷¹ Giorgio Marfella, "From Heat-absorption to Speculation: the Troubled Evolution of International All-glass Architecture in Melbourne," in *Gold*, proceedings of the 33rd Annual Conference of the Society of Architectural Historians, Australia and New Zealand, Melbourne 6-9 July 2016, 404-417.

⁷² "The A.C.I. Story," *Architecture Today* 10, no. 1 (November 1967): 41-43.

⁷³ "Now Pilkington ACI Limited," *Architecture Today* 14, no. 11-12 (December 1972 – January 1973): 17.

intensity and posing overheating challenges for air conditioning at the perimeter of the building, particularly in summer time.⁷⁴



Figure 6.11

Royal Insurance Building, 430-444 Collins Street, 1962-66; pre-glazed concrete precast façade under construction

The thermal insulation benefits of double glazing had been known since the 1940s but high cost and poor reliability left insulating glass units in evolution until the 1970s.⁷⁵ Double

⁷⁴ Albert G.H. Dietz, "Potentialities of Glass in Building," *Architectural Record* 109, no. 4 (April 1951): 141-148.

glazed units in Australia were distributed by Glaverbel with a licenced version of LOF's "Thermopane",⁷⁶ and early applications of reflective coatings were available in the Australian market from at least the early 1960s.⁷⁷ Most office buildings in Melbourne in the 1950s and 1960s continued to use single pane heat-absorbent glass, but one of the first large scale applications of double glazing was at the Royal Insurance Building in Collins Street [map 6A, 24]. There, "Twindow" units, supplied from America by PPG, were directly fixed with neoprene zippers onto precast concrete façade panels. The panels were craned on-site as pre-glazed units spanning from floor to floor and were structurally fixed from the inside of the building. This façade construction system anticipated the methodology of façade installation of unitised panels that is pervasive today, and made considerable impression in Melbourne in the 1960s when it was described as a "break-through" for the local building industry.⁷⁸

The demise of the crystal tower

Precast concrete construction systems evolved suddenly in Australia from the 1960s.⁷⁹ Early applications were experimented in particular in Melbourne's tall office buildings, where polished wall panels of natural stone aggregate, - known as reconstructed or reconstituted stone - were developed and used for the first time in the core construction of Hume House, subsequently at ICIANZ House and thereafter on several other tall office building façades until the 1990s.⁸⁰ Precast concrete façade technology developed further in the 1970s, incorporating drained joints and pressure equalisation chambers, and in response to rising concerns of energy-performance in tall buildings.⁸¹ These contingent factors induced a widespread shift towards heavier and better performing façade systems. Growing use of precast façades was paralleled by a decline of early light-weight stick

⁷⁵ "Needed: a Standard for Insulating Glass," *Architectural Record* 149, no. 2 (February 1971): 133-136.

⁷⁶ "Product Reports: Glass, Insulation, Windows, Air Conditioning," *Architecture Today* 3, no. 6 (October 1961): 37-39.

⁷⁷ "Product Reports: Glass, Insulation, Windows, Air Conditioning," 38.

⁷⁸ "Trade Topics: Break-Through," *Architecture Today* 6, no. 10 (August 1964): 21; "New Method of Pre-glazed Precast Concrete Cladding," *Architecture and Arts* 12, no. 7 (July 1964): 27-28; "Notes and News: Pre-glazed Precast Concrete Cladding," *Building Economist* 3, no. 3 (November 1964): 85. In Melbourne, the methodology of installation of unitised facades was used in tall building aluminium curtain walls only from the late 1980s and early 1990s; for example at the Argus Centre [map 5B, 70] and at Bourke Place [map 8A, 69], while stick curtain walls were still used at Rialto [map 5D, 64], 120 Collins Street [map 8A, 69] and Melbourne Central [map 3A, 66]; Unitised curtain walls have become dominant in the city ever since.

⁷⁹ K. J. Cavanagh, "Precast Concrete in Building," *Constructional Review* 33, no. 7 (July 1960): 33-36.

⁸⁰ Rico Bonadi, interview, 1 September 2014.

⁸¹ "Façade Design for Energy Conservation," *Constructional Review* 48, no. 4 (November 1975): 48-61.

façade systems based on aluminium and heat-absorbing glass, which in Melbourne became associated also with noteworthy building failures.

The first important episode of curtain wall failures in Melbourne occurred in 1956, when colourback spandrel panels of annealed plate glass produced by ACI failed at the General Motors Factory in Dandenong, Victoria. The origin of this failure had to be ascertained by a scientific investigation, and CSIRO scientist Ron Ballantyne was engaged to travel to the USA to seek answers. Travelling overseas, Ballantyne entered into contact with leading experts of glass and curtain wall technology, returned to Melbourne with first-hand information about similar failures that occurred in America, and concluded by identifying thermal breakage as the cause of the failure at the General Motors factory.⁸²

The second major glass debacle occurred in the most iconic crystal tower of the city, ICIANZ House. Between 1960 and 1961, seventy-one spandrel panels of blue “Pan-O-Glass”, a toughened product imported from Belgian glass-maker Soberlever, broke and fell from the western façade of the slab. Following further research carried out by CSIRO and Ballantyne, the problems of ICIANZ House were linked to nickel sulphide inclusions in toughened glass, which, after learning from the thermal breakage of the General Motors Factory, was used at ICI House to prevent thermal breakage. Thereafter, ICI House became a milestone case for the understanding of a new problem in material technology. The spontaneous breakage of ICIANZ’s toughened glass, attracted “considerable interest” worldwide and caused severe repercussions for all-glass architecture in Australia.⁸³

By the turn of the 1960s, arguments that proposed to abandon architectural trends with largely glazed façades were presented in Australian architectural and engineering periodicals. Tellingly, Australian glass-maker ACI, built its owner-occupied headquarters in Melbourne [map 1D, 28] with a building enclosed in precast concrete panels of polished quartz aggregate. In 1964, the journal of the AIRAH presented the precast concrete clad winning scheme of the Victorian State Government Offices in Melbourne as “the largest commercial air conditioning project yet attempted in Victoria”. The project in Melbourne

⁸² SLV, Stephenson and Turner Archives, volume 1047, E.R. Ballantyne, “Cracking of Coloured Glass Used as a Wall Cladding,” February 1957. The findings of Ballantyne’s work are presented also in *Architecture in Australia* 46, no. 2 (June 1957): 72-75.

⁸³ Eric Ronald Ballantyne, “Walls and Weather,” *Architectural Science Review* 21, no. 1-2 (March-June 1978): 19-20.

was in evident contrast with Sydney's fully glazed headquarters of Flotta Lauro, a project that was featured in the same article; the two projects shared an innovative method of air conditioning that combined air supply with the recovery of unused heat from light fittings. But the two office buildings, however, differed significantly for their envelopes; depicted side by side in the AIRAH's journal, they served as the visual commentary of a somehow rhetoric question: "More glass - or less for Australia?"⁸⁴



Figure 6.12

State Government Offices, Melbourne (above) and Flotta Lauro Building, Sydney compared in *Australian Refrigeration, Air Conditioning and Heating*, 1964

⁸⁴ "More Glass or Less for Australia? Victorian Government Offices," *Australian Refrigeration, Air Conditioning and Heating* 18, no. 11 (November 1964): 38-39.

The reflective glass box

In the 1950s and 1960s, the use of glass as the dominant façade material showed severe limitations in the Australian climate, which derived from the inherent poor performance of the products and materials available at the time. To these limitations the global industry of glass responded with reflective glass, a product innovation geared towards better energy performance.⁸⁵

In 1974, a study made by Melbourne-based mechanical engineers Bassett and Partners was published in the AIRAH journal. Based on the analysis of a multi-storey office building in Melbourne, the study conveyed the source of industry-wide concerns about glass in office buildings. The study showed the direct impact of different glazing products on the variation of initial and operating cost of air conditioning. Taking regular plate glass as a base case, a change to single-glazed heat-absorbent glass would reduce capital cost by \$2,700 and operating cost by \$150 per year. Upgrading to gold reflective “Stopray” double glazed units would reduce capital cost by \$32,000 and operating cost by \$1,550 per year.⁸⁶

Before the latest technological advancements in reflective glass could be tested overseas and adopted widely in Australia and in Melbourne, the unreliability of glass as a cladding material went hand in hand with escalating problems of artificial environmental control in office buildings, and this situation supported the shift towards a greater use of precast concrete envelopes.

In Melbourne and in Australia, in parallel to this shift, tall office building of the 1960s and 1970s developed also new design strategies to respond more holistically and on a long-term basis to the challenges set by sealed air conditioning enclosures. These strategies included architectural design considerations about floor plan shape and built-form and sought more efficiency through quality of materials – like reflective glass - and the reduction of openings in façades.

⁸⁵ Marfella, “From Heat-absorption to Speculation: the Troubled Evolution of International All-glass Architecture in Melbourne,” 410-417.

⁸⁶ A.B. Coleman, “Air-conditioning, Maintenance and Operating Costs – The Design Approach – Case Histories,” *Australian Refrigeration, Air Conditioning and Heating* 28, no. 3 (March 1974): 22-27.



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Figure 6.13

Reflective glass advertising in Australia from Pilkington ACI, 1985

Total energy

Through the 1970s, before the advent of more energy-efficient systems such as VAV, air conditioning remained a matter of great concern, particularly among developers and

owners of office buildings. The cost of basic plant, distribution system and operation was indeed of great influence for the feasibility of tall office buildings.

In 1974, a Victorian Property Manager of the Australian Mutual Provident Society gave account of these influences from an owner's perspective.⁸⁷ AMP estimated that for a hypothetical office building in Melbourne, air conditioning would consist of a quarter of the total capital outlay of a project. A large share of the cost was taken by operating costs. For an expected building life of 50 years, AMP estimated that for every \$24,000 of capital expenditure spent to upgrade or improve the efficiency of a basic air conditioning system, maintenance and operation should be reduced in the order of \$2,200 per annum.⁸⁸ Two years earlier, a study of the Division of Building Research of the CSIRO indicated air conditioning for office building to be the "biggest single cost item" and to be of "great concern to the owner", costing up to 20% of total capital outlay, and, on a "present worth" basis and including operation and maintenance, costing up to 40% of the capital required to erect, operate and maintain the building.⁸⁹

Items of direct cost, however, were not the sole concern. Other influences were connected less directly with monetary implications of purchase and operation. An approach advocated by AMP in the 1970s was to consider holistically the methods of power generation in buildings and to evaluate the interaction of the conditioning system with the architectural design of the building. In an attempt to seek holistic solutions to global energy problems, AMP and their anchor tenant BHP tested an innovative concept of energy use and management for tall office buildings. The system, known as "total energy", consisted of an in-built and self-sufficient source of power generation fuelled by natural gas in lieu of diesel oil. The total energy approach was implemented and used in Melbourne at BHP House and AMP considered it for application also on other large projects, which indicated acceptable return prospects. But, despite the example of BHP House, AMP opted not to proceed with the total energy approach due to concerns related to the introduction of "miniature power stations" inside city buildings and having taken into consideration

⁸⁷ E. Webber, "Air-Conditioning as an Investment," *Australian Refrigeration, Air Conditioning and Heating* 28, no. 1 (January 1974): 11-13.

⁸⁸ Webber, 12.

⁸⁹ M. Anson and J.W. Spencer, "Office Building Costs as a Function of Envelope Design," *Architectural Science Review* 16, no. 2 (June 1973): 118-128.

opposition from public supply authorities against such methods of privately autonomous power generation.⁹⁰

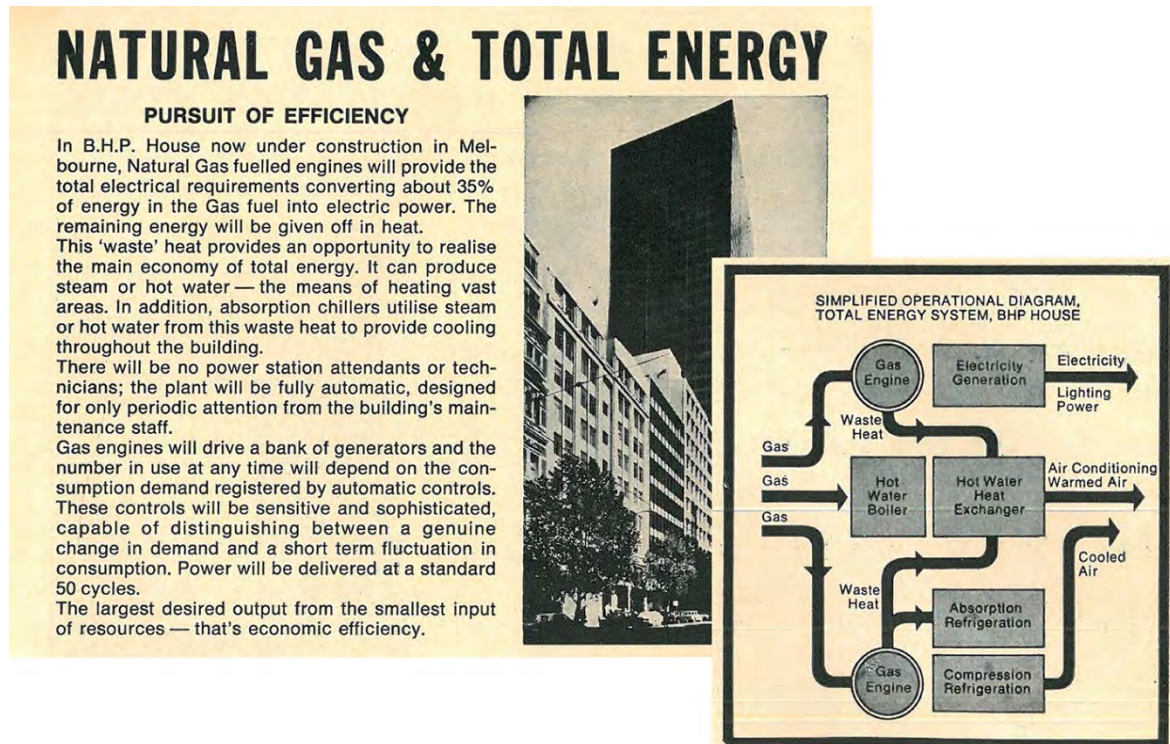


Figure 6.14

Description and schematics of the “Total Energy” natural gas fuel system used at BHP House, 1970

The function of the envelope

In the early 1970s, using building data gathered from built examples in Melbourne, CSIRO developed a computer program able to assess the overall impact of building envelope design through the computation of air conditioning loads for multi-storey office buildings.⁹¹ The program considered initial and operation cost of air conditioning as a function of a multitude of design factors, including the influence of plan aspect ratio, building height, use of sunshades and percentage of glass area. In economic terms, the reduction of glass area was found to be the most effective measure to cut cost for lowering simultaneously envelope size and cooling loads. The study claimed that influences of change in plan ratio were somehow secondary, but much more significant for smaller floor plates - e.g. in buildings with higher wall / floor ratio. Results showed that plans with

⁹⁰ Webber, “Air-Conditioning as an Investment,” 12.

⁹¹ Anson and Spencer, “Office Building Costs as a Function of Envelope Design, 126.

aspect ratio of one – square plan buildings – were more efficient than rectangular plans. Square plan buildings were able to reduce air conditioning plant capacity by 12% in small footprints (600 sqm GFA) and by 9% in large ones (2,350 sqm).

Likewise, air conditioning cost had a premium that grew with building height and with higher impact in shorter rather than higher buildings. Considering a variation in building height of five floors, from 10 to 15 storeys, air conditioning costs would rise by 13%. In a taller building, with a building height variation of 9 floors, from 16 to 25 storeys, air conditioning cost would grow by 14%, hence, in proportion, with much less impact than in a shorter building.

TABLE 5. INFLUENCE OF BUILDING PLAN RATIO
Glazing ratio 40% and shading coefficient 0.6 on all faces
Figures are averages of results for plan ratios shown*

Plan Ratio	Gross Floor Area (squares)	No. of Storeys	Rentable Floor Area (squares)	Total Envelope Area (ft ² /r.sq.)	A/C Plant Capacity, P _r (tons/r.sq.)	Initial Cost, C _i (\$/r.sq.)	Total Cost, C _t (\$/r.sq.)	Type of Wall (See Table 4)
3 and 1/3	600	12	382	104.8	0.63	984	1919	D
2 and 1/2	600	12	382	95.4	0.59	914	1792	D
1	600	12	382	92.8	0.56	878	1717	D
3 and 1/3	600	12	400	100.1	0.72	1054	2122	S
2 and 1/2	600	12	400	91.1	0.67	978	1977	S
3 and 1/3	2350	20	1455	66.8	0.52	689	1439	D
2 and 1/2	2350	20	1455	64.5	0.49	662	1377	D
1	2350	20	1455	61.8	0.47	639	1329	D
3 and 1/3	2350	20	1500	64.8	0.58	731	1567	S
2 and 1/2	2350	20	1500	62.6	0.55	699	1492	S
1	2350	20	1500	60.0	0.53	672	1434	S

* The differences in P_r, C_i, C_t between the two orientations were not more than 1%, results for buildings with long sides facing E and W (plan ratio <1) being slightly higher than those with long sides facing N and S (plan ratio >1)

Figure 6.15

Comparative chart of study prepared by CSIRO showing influence of plan shape on cost of envelope and air conditioning cost for Melbourne multi-storey office buildings, 1973

CSIRO concluded that suitable design and shape of the building envelope could account for over 30% of the peak air conditioning load, and consequently up to 7.5% of the capital cost of the building. Significantly, some of the conclusions of the scientists of CSIRO were echoed and quoted *verbatim* by AMP in the AIRAH journal. AMP added the consideration that, from an owner perspective, any reduction in window size had to be offset by “added

income due to a more attractive concept and layout, for example a free standing tower with glazing on four sides, compared with a building glazed on two sides only”.⁹²

6.3 Offsetting the premium for height

The steel paradigm from dry to composite construction

The problem of height, weight and clear span

While the economic problem of running costs in tall office buildings revolved around the integration of façade and building service technology, the problem of construction costs revolved around structural efficiency. In the Australian construction industry, the central topic of discussion with high rise structures focused on the economic advantage of concrete versus steel. The choice of the primary material was interlocked with general aspects of efficiency vis-a-vis overall geometry, configuration and mass of structural systems. These matters were explained in the 1970s by cost consultant Harry Wexler of Rider Hunt, who indicated that problems of lateral stability seemed to increase for structure more than forty storeys high resulting in additional costs and different engineering solutions:

The stability of a tall structure is obviously inhibited by slenderness. As buildings grow taller in relation to their size and shape on plan, lateral stability becomes an increasingly important factor in design. (...) Strictly speaking, height and column span should not be confused because on the face of it there is no reason why a 40ft clear span is any more desirable in a high building than in a low one and it is certainly economically wasteful in a low one. However these days, higher buildings and greater spans often run together, so that the structural cost of a high rise building rises even higher. In New York clear spans of 55 and 60 ft. are being adopted on new high rise buildings and the reason appears to be that a very high structure must be stiffened by throwing weight into the central core. An intermediate column prevents this happening.⁹³

As economic pressures stemming from building height facilitated recourse to column-free spans to provide overall lateral stiffness, high rise construction technologies evolved in Australia along two different paths of innovation. Although marked by the industrial alternatives of steel versus concrete, these paths of technological change developed interchangeably and left avenues open for composite integration. In fact, the competitiveness of these two key sectors of the industry did not prevent at all the fact that

⁹² Webber, “Air-Conditioning as an Investment”: 11.

⁹³ Harry Wexler, “The Economics of Construction Cost of High-Rise Buildings in Australia,” *Building Economist* 10, no. 2 (June 1971): 4.

the two materials coexisted and flourished with a wide inventory of hybrid structural solutions that were applied in several tall office buildings in Melbourne.

Steel scarcity in Australia after WWII

In the early 1950s, Australia was affected by a severe scarcity of steel, which originated during the war and endured for a decade after the end of the conflict. This situation made imperative seeking structural design efficiency and minimal usage of the material. Shortage of steel supplies was nationwide, and slowed down the restart of private construction.

In 1951, only one sixth of steel domestic demand was met by local and international supply. This impediment was of such concern that the Australian Prime Minister had to address directly the issue in person. In a letter addressed to the Standards Association of Australia, the Premier wrote to advocate a revision of the existing code prescriptions for steel construction; following these pressures, the Australian Standards Association decided to increase the ultimate tensile strength allowed by code for the design of steel structures.⁹⁴

Within these economic strains, any new, light-weight and time-reducing method of steel fabrication was welcomed by the building industry, but in many circumstances, steel remained uncompetitive in price and difficult to source. In the mid-1950s, in fact, in-situ concrete was still the primary structural material of choice for a number of early office blocks built in Melbourne, and it was used at Gilbert Court [Map 8A, 01], Coates Building [Map 8B, 11] and the seminal six-storey square office block of Feltex House in Nicholson Street.⁹⁵

Early all-steel and composite systems

Once economic conditions improved in the mid-1950s, new building technologies such as welding, high-strength bolting and spot-welding became ordinary and they were consolidated in a nationwide boom of high-rise projects. By the second half of the 1950s, fully welded steel frame construction was normal practice in Australian tall office buildings. In Melbourne, two different methodologies of high-rise steel construction

⁹⁴ "Economy in the use of Steel for Structural Purposes," *Building Light and Engineering*, July 24, 1952, 52-55.

⁹⁵ PROV, VPRS 11200, City of Melbourne, Building Application Files no. 31992. Gutteridge Haskins and Davey, structural drawings, 1957.

developed, but one in particular became prevalent for tall office buildings at least until the 1970s.



Figure 6.16

Steel skeleton frames under construction of ICIANZ House, 1958 (left), and Colonial Mutual Life Building, 1961 (right)

The first was the all-steel rigid frame, based entirely on dry prefabricated methods and complemented by light-weight gypsum plaster or asbestos fire-proofing. The second consisted in the fabrication of fully welded steel frames encased with in-situ concrete for fire-proofing. The first method was exemplified in Melbourne by ICIANZ House, where casts of gypsum plaster were used for fire-proofing in combination with precast concrete flooring.⁹⁶ This construction method was anticipated and developed in the city by Hume House and a similar methodology was used at the Electrolytic Zinc Company Building in Lonsdale Street where steel framing was fire-protected with sprayed asbestos [map 2B, 10].

⁹⁶ Rico Bonaldi, interview, 1 September 2014.

The second method was more diffused and used for the great bulk of office buildings completed between the late 1950s and the mid-1960s.⁹⁷ Concrete encasing was generally applied to vertical framing and primary floor supports, and completed horizontally with precast concrete planks over steel beams, trusses or with monolithic in-situ concrete slabs.

This technique was exemplified by Shell Corner, which had steel core and external rigid framing both encased in concrete. Floor construction used primary steel trusses and precast concrete floor planks. This partial-prefabrication of the floor was known to have saved considerable building time and on-site labour on the job.⁹⁸ A similar method was used at the Colonial Mutual Life Building and at the Prudential Assurance Building in Queen Street, where the floors were self-supporting double ‘tee’ concrete planks. In some instances, floor construction was completed with concrete upstand work, which fulfilled the double role of spandrel and floor to floor fire-separation. This approach was used, for example, at Pearl Assurance House [map 6A, 16] and HC Sleigh Corner [map 2D, 21].

Other composite steel-concrete flooring systems developed gradually from the late 1950s. Thereafter, these systems prospered due to an established network of manufacturing and distribution of corrugated steel sheets, which were largely used in Australia for residential roofs. The first experiments with this technology were due to the receptiveness of stud-welding among designers and builders, who were willing to innovate with dry construction methods. Harvey Brown, an engineering partner at Bates Smart & McCutcheon, is credited to have introduced corrugated steel sheets to be completed by wearable concrete topping in combination with spot-weld shear studs.⁹⁹ This idea was then developed commercially by Lysaght, a manufacturer of corrugated steel roofing,¹⁰⁰ into the corrugated sheet product known as “Celdek”. Through the 1950s and 1960s, Lysaght’s corrugated steel flooring developed further with products like “Trofdek” and “Tri-lok”.¹⁰¹ In these early steel flooring systems, steel trays acted as the principal structural material with concrete serving

⁹⁷ Uniform Building Regulations, Victoria, Victorian Government Gazette 87, 28 June 1945, clause 705, “Type 1 – Framed Fire Resisting Construction.”

⁹⁸ “Precast Concrete Floor Units Save Building Time,” *Architecture and Arts* 8, no. 89 (March 1961): 65.

⁹⁹ Rico Bonaldi, interview, 1 September 2014.

¹⁰⁰ The steel fabrication company of John Lysaght was founded in 1897, in Bristol, England, and produced corrugated steel sheets for export to Australia. In 1921, after acquiring a site nearby steel-making plants of BHP, Lysaght transferred to Australia, where BHP became its major steel supplier and business partner.

¹⁰¹ “The Product Makers: the John Lysaght Story,” *Architecture Today* 9, no. 7 (May 1967): 34-35.

only as a practicable finish; they were not, in engineering terms, a fully composite steel-concrete floor system.



Figure 6.17

BHP House, “Bondek” composite metal decking under laboratory testing (left) and installed on site (right)

BHP House: ‘all-steel’ *non plus ultra*

From the end of the 1960s, Lysaght commercialised “Bondek” decking, a new composite steel-concrete engineering solution. Unlike Lysaght metal decking products, Bondek served both as formwork and negative tensile reinforcement at the bottom of a concrete floor slab, bringing additional strength, and offering opportunities of economic optimisation of the structural performance in clear span floors.¹⁰² In Melbourne, this product was used, extensively and possibly for the first time worldwide, in the floors of BHP House.¹⁰³

By the late 1960s, welding technology increased its appeal for high-rise structures due to advancements in automation that reduced manual welding on site. News of the substantial benefits of semi-automatic welding techniques, particularly as applied to the fabrication of non-standard sections in high-rise structures, reached Australia from the United States in the 1960s.¹⁰⁴ Large scale and customised structural steel prefabrication was used in Melbourne at AMP Square in 1968. The 6,300 tons of structural steel of the building were mostly fabricated off-site in the southern suburb of Sandringham, where the steel

¹⁰² “The Product Makers: the John Lysaght Story,” 35.

¹⁰³ Rico Bonaldi, interview, 1 September 2014.

¹⁰⁴ “Structural Steel Fabricator Doubles Production – But Not Work Force,” *Contracting and Construction Engineer* 21, no. 7 (March 1968): 80-81.

contractor, Johns and Waygood, built a range of custom made sections using the innovative fully automated process of submerged arc welding. These sections included long span girders with stub-ends and column profiles with cap plates, which speeded significantly erection on site.¹⁰⁵

The principles of large-scale custom steel fabrication used for AMP Square were adopted and expanded further in the construction of BHP House. E.A. Watts, the general building contractor of the project, subcontracted the company Australian Iron and Steel for the prefabrication of the primary structure and of the building envelope.¹⁰⁶ Steel components had a high level of customisation, including cruciform columns assembled from 5 inch thick steel plate, castellated floor beams and girders, and the fabrication of all the façade panels including flat steel plates used for cladding of spandrels and columns. The off-site production of BHP House was carried out with the extensive use of automatic methods of fabrication, including photosensitive oxy flame cutting and submerged arc welding.¹⁰⁷

At BHP House, given the size of the structural components, a considerable amount of on-site welding was still required. A field-welding contractor, Transweld, was engaged specifically for the task to complete the assembly of large prefabricated components, which included façade beams, mullions and belt trusses. Site welding for BHP House took a considerable effort of logistics on site, making extensive use of semi-automatic welding techniques to speed up labour. Site welding was carried almost on a non-stop basis during the erection of the tower and it was executed mostly in a dedicated zone at the ground floor before the larger elements could be lifted in position by crane.¹⁰⁸

The structural connections at height were mostly bolted with ultra-high strength bolts. The bolts were of a large size never used in Australia before, and required the importation of special compressed air fastening tools from the USA.¹⁰⁹ Hoisting and handling for the assembly of large steel parts required a self-climbing crane that was purpose-built by the

¹⁰⁵ "Welded Steel Framework for Melbourne's Tallest Building," *Contracting and Construction Engineer* 21, no. 7 (March 1968): 35-36.

¹⁰⁶ Broken Hill Proprietary Company (BHP) and E.A. Watts, *BHP House: Fabrication – Erection*, (Melbourne: Broken Hill Proprietary, 1971).

¹⁰⁷ BHP and E.A. Watts, 5-21.

¹⁰⁸ BHP and E.A. Watts, 35-38.

¹⁰⁹ BHP and E.A. Watts, 33.

Australian crane manufacturing company Favco. The model developed for the project, the Favco 1500, was able to lift columns with a maximum weight of 25 tons.¹¹⁰

The all-steel approach of the primary structure and of the façade of BHP House was complemented by concrete encasing to comply with the fire safety prescriptions of the UBR. The interface between steel facings and concrete was achieved through an extensive use of spot welded-studs. Typical façade panels were floor to floor high and 40 feet wide; they were prefabricated, prefinished and completed offsite; each panel was fitted with 148 stud-weld shear connectors facing the concrete pour at the rear of the panels.

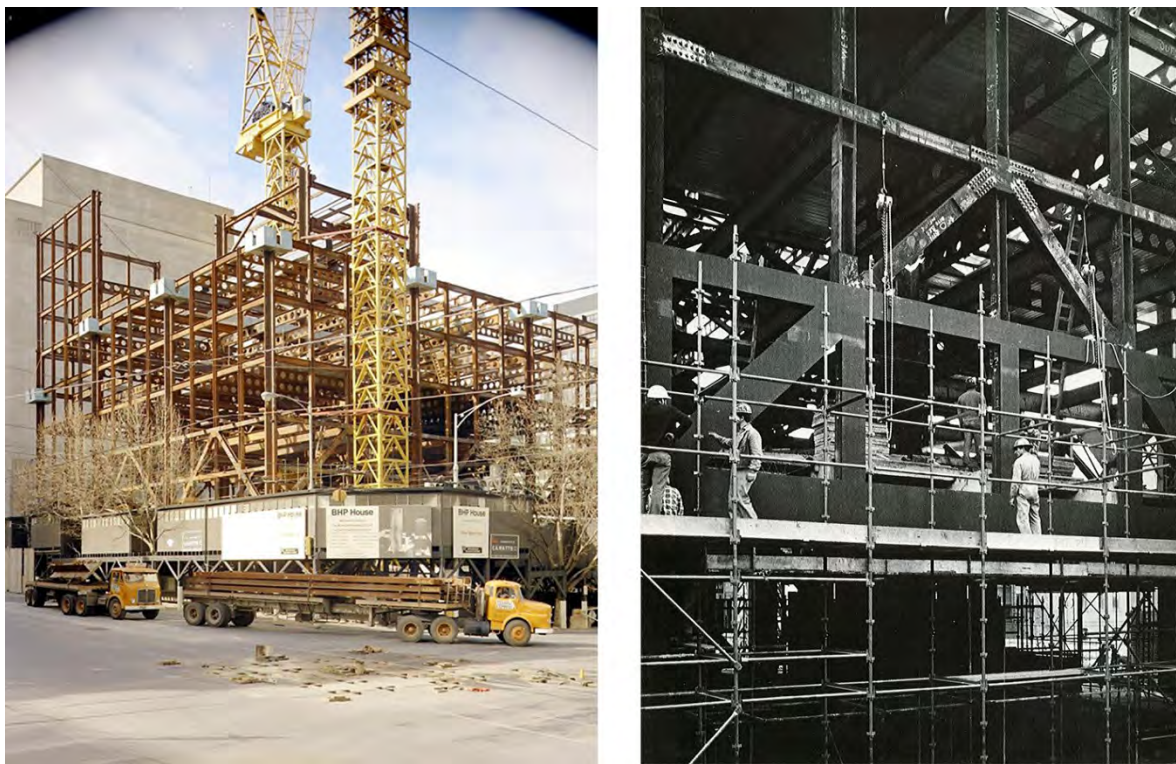


Figure 6.18

BHP House, all-steel frame and core (left) and belt trusses (right) under construction

Shear truss experiments from Chicago to Melbourne

The construction of BHP House was intended to become the paradigm of the finest structural steel technology in Australian tall buildings. This exemplar went beyond the technology of materials and included innovative methods of engineering design. Being almost twice as large of any precedent structure in Melbourne, BHP House was a built-

¹¹⁰ BHP and E.A. Watts, 32.

experiment to obtain real-scale reliable data for future wind assessments in Melbourne, and the project helped gathering new knowledge and data for the emerging discipline of wind engineering. The structural engineering of the tower was calculated using project-specific wind load assumptions established at the boundary layer wind tunnel at Monash University in Melbourne. The predictions obtained in the tunnel were consequently compared with measurements on site in order to validate the accuracy and the reliability of wind tunnel testing for future tall building projects.¹¹¹

BHP House introduced a new structural concept for high-rise construction.¹¹² Fazlur Khan was engaged as the chief structural design engineer from SOM Chicago, and devised for this project the belt truss and outrigger structural system. The novelty of the concept was described as one structural system acting “in concord” and developed with a “harmonious relationship” where “all the parts [were] welded to suit a universal purpose”.¹¹³ Khan proposed the belt and outrigger system as a strategy to offset the structural “premium for height”, which in the engineer’s definition designated the increase of material needed to overcome the effect of lateral loads:

(...) for taller buildings the wind and earthquake stresses normally exceed the allowable overstress so that it is necessary to increase the column and beam sizes to control the total combined stresses. This increase of material in the beams and columns may then be called ‘premium for height’ because such increase is primarily caused by the height of a tall building.¹¹⁴

The solution developed for BHP House in Melbourne was a “further refinement of the shear truss typology”, which the American engineer had adopted earlier at the Chicago Civic Centre.¹¹⁵ BHP House was the next evolutionary step in Khan’s repertoire of structural inventions tested at Skidmore Owings Merrill. In comparison with a conventional rigid frame of the same height, the trusses, which were located at the top and at mid-level of the tower, helped to reduce sway by 30%. At the same time, this

¹¹¹ BHP’s Melbourne Research Laboratories, “Instrumentation,” in *BHP House: Mechanical and Electrical Services – Instrumentation*, (Melbourne: Broken Hill Proprietary, 1971): 13-19.

¹¹² “New Concept in Building Construction: B.H.P.’s New National Headquarters,” *Contracting and Construction Engineer* 23, no. 5 (May 1969): 13-14.

¹¹³ “New Concept in Building Construction,” 14.

¹¹⁴ Fazlur R. Khan, “Recent Structural Systems in Steel for High Rise Building,” *Steel Construction* 4, no. 1 (1970): 2-12.

¹¹⁵ Khan, 6.

engineering device reduced the “premium for height” by limiting the weight – and therefore the cost - of the steel structure to 20 pounds of steel per square foot of area.¹¹⁶

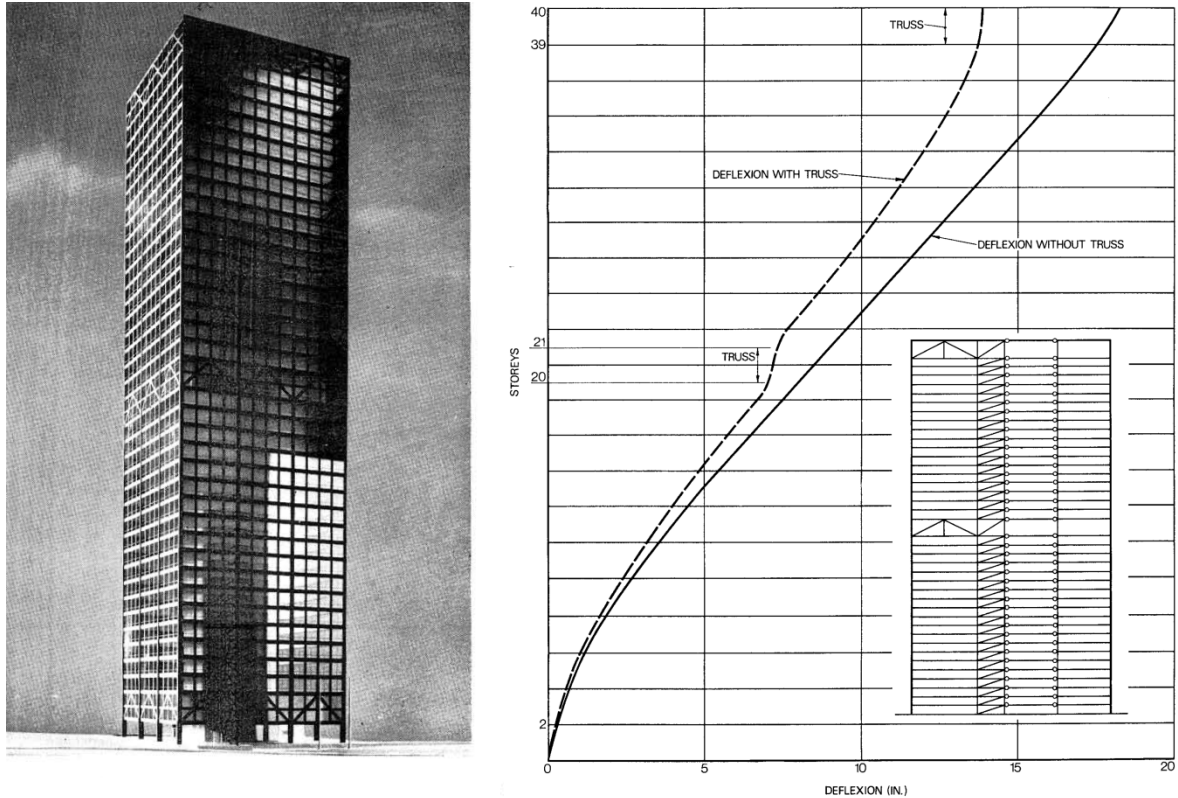


Figure 6.19

BHP House, model (left) and graph by structural engineer Fazlur Khan (SOM Chicago) showing reduced sway introduced by shear trusses at levels 20-21 and levels 39-40 (right)

Composite solutions, from the 1970s to the 1990s

The construction of BHP House was an extraordinary accomplishment that introduced new technologies and engineering practice in Australia. Despite the all-steel appearance, however, the building relied on concrete encasing of primary steel members for fire safety. Moreover, the building became known in the city for “the big pour”, one of the largest uses of *in situ* concrete ever done in Australia at the time, a feat necessary for the raft footing designed to balance the large overturning moment of the tower.¹¹⁷ In fact, after BHP House, in Melbourne tall office building construction abandoned the all-steel approach and

¹¹⁶ “New Concept in Building Construction,” 14.

¹¹⁷ BHP and E.A. Watts, *BHP House: Fabrication – Erection*, 31.

shifted towards composite steel-concrete construction, which continued to be used until the 1990s.¹¹⁸



Figure 6.20

Collins Place, composite steel flooring (left) and slip-formed concrete core (right) under construction

In 1971, the two towers of Collins Place [map 8D, 54, 55] were initially conceived as an all concrete structure in order to “produce maximum economy”.¹¹⁹ The initial concept, developed by the American structural engineers of Weiskopf and Pickworth in local association with John Connell and Associates, was subsequently transformed into a composite structure.¹²⁰ The structural solution adopted for Collins Place consisted of double storey-high F-shaped steel frames erected around the perimeter and supported at the inner end by a slip-formed concrete core. The external columns of the F-shaped frames were consequently fully encased in concrete using three-dimensional T-shaped precast concrete panels, which also provided permanent formwork for a continuous concrete edge

¹¹⁸ A. Firkins, “Steel in City Buildings,” *Steel Construction* 17, no. 1 (1983): 2-24.

¹¹⁹ John Connell and Associates, “Structure,” in I.M. Pei and Partners, *Collins Place: Development Plan*, 1971.

¹²⁰ “Collins Place,” *Constructional Review* 50, no. 2 (May 1977): 54-61.

beam. The resulting structural typology was a concrete “tube in tube” that used steel framing as an auxiliary method of erection of temporary and lost formwork.¹²¹

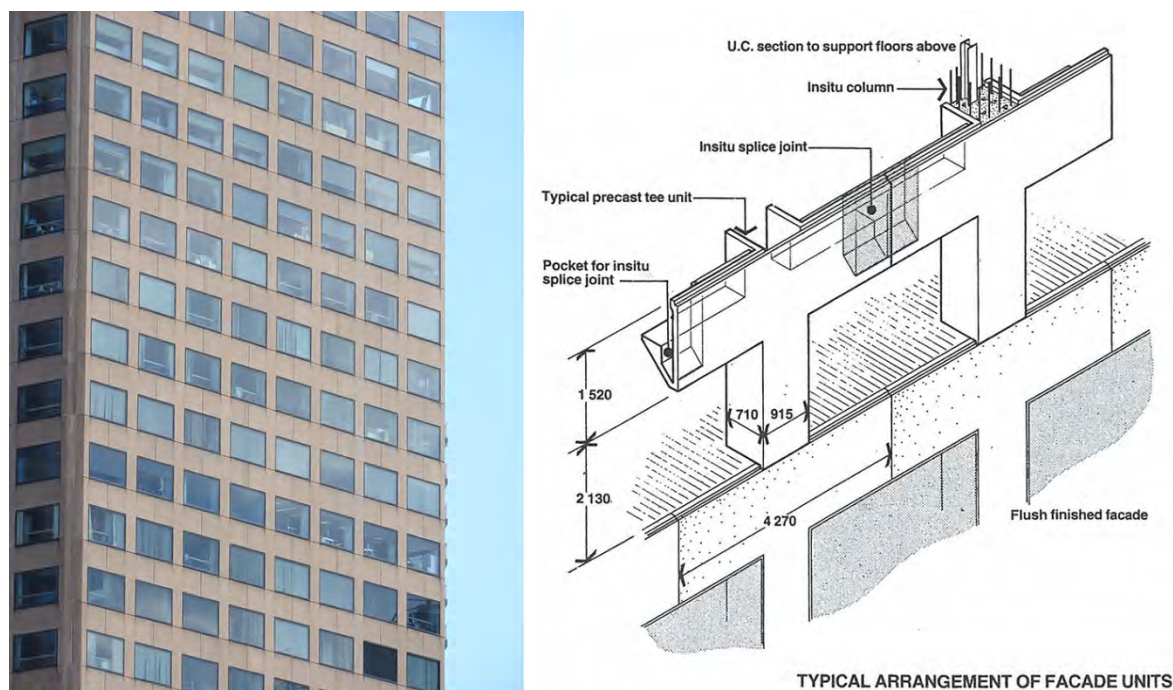


Figure 6.21

Collins Place, external view and isometric diagram of external tubular frame with precast façade panels

In the late 1980s, the construction company Grocon, notwithstanding a remarkable expertise demonstrated earlier with all-concrete high-rise technology, recurred also to hybrid construction solutions in the construction of two skyscrapers in Collins Street. At 101 Collins Street [map 8C, 71], the structural approach of the cruciform tower was composite with external frame and floor construction made entirely of steel in combination with a central concrete core. At 120 Collins Street [map 8A, 69], composite construction methodologies were used horizontally, where they were refined to the extent that some of the tower floors were completed on floor working cycles of only three days.¹²² From the perspective of structural typology, 120 Collins Street was a hybrid concrete tube in tube with vertical elements of in-situ concrete and horizontal elements of steel, which in Melbourne had already been experimented upon in a similar form in the tower of the State Bank Centre [map 6B, 60].

¹²¹ “Collins Place,” 59.

¹²² “120 Collins Street,” *Constructional Review* 65, no. 1 (February 1992): 20-27.

Melbourne Central [map 3A, 66] was also built with a hybrid structure of concrete and steel. The inner core was slip-formed, floors were steel framed with composite concrete slabs on steel decking, and the perimeter frame was made of steel columns and precast concrete edge beams. Steel columns were erected in synchrony with precast beams acting as spandrels and subsequently steel members were fire-proofed by concrete encasement. This hybrid approach, designed by the local engineers of Connell Wagner, the same engineers involved at Collins Place, combined the benefits of fast high-rise steel erection, while the relatively high cost of the material was offset by added mass through concrete elements, in this case used both in-situ and in precast form.¹²³

Casselden Place [map 4B, 74], located on a corner site over the Melbourne underground rail loop, was built with an innovative hybrid solution.¹²⁴ The building used high-strength concrete (70 Mega Pascal strength) in combination with concrete filled steel columns, a technology that, at that time, had only a few known precedents worldwide. The circular columns of the tower were fire-proofed and strengthened by high-strength unreinforced concrete pumped inside the steel tubes. The columns were erected with double storey-high lifts. Relying on the support of the bare steel, the columns could carry loads up to six-storeys over, where subsequent trades could move spiralling upwards with the installation of metal decked composite floors. High-strength concrete was subsequently pumped inside the tubes from a hole at the base of the column. By pumping concrete from below upwards the requirement for vibration was eliminated.¹²⁵ Casselden Place proved to be an economically viable option among steel-based structures, since it allowed the erection of frames to “jumpstart” simultaneously construction on several fronts, while giving the additional benefit of lateral resistance with heavier concrete-filled construction.¹²⁶

¹²³ “Melbourne Central, Melbourne, Australia,” in Ryszard Kowalczyk, M., Robert Sinn and Max. B Kilmister [eds], *Structural Systems for Tall Buildings: Systems and Concepts* (New York: McGraw Hill, 1995), 27-31.

¹²⁴ “Casselden Place, Melbourne, Australia,” in Kowalczyk, Sinn and Kilmister [eds], 127-129.

¹²⁵ “Casselden Place, Melbourne, Australia,” 128.

¹²⁶ M. J. Barker, “Concrete Filled Tube Columns,” in *Building the Future: Innovation in design, materials and construction*, edited by F.K. Garas et al. (London – New York: Spon 1994): 349-357.

6.4 Critical mass

All-concrete high-rise, from post-tensioning to mechanisation

Concrete problems, concrete solutions

Immediately after World War II, the Australian concrete industry was still relatively young and with a marginal role in the high-rise sector. But in the 1960s and 1970s concrete know-how and applications in Australian high-rise grew considerably. By the 1980s, concrete became the dominant primary material of core and skeleton construction in Melbourne's tall buildings.

Modern techniques and applications of concrete in large scale projects were introduced in Australia around 1935 and gathered momentum with the first off-site processing plant of 'ready-mix', which was opened on Glebe Island near Sydney's CBD in 1939. Before ready-mix gained popularity, concrete construction had to rely to inaccurate mixing done by hand on site,¹²⁷ but immediately after the conflict, the Australian building industry could already rely upon established premixing methods. A capillary network of off-site manufacturing and delivery had grown, at first stimulated by a nationwide scarcity of steel, and then by the demand for concrete as an infill material giving fire-proofing and additional mass for lateral resistance in light-weight steel framing.

In 1963, *Constructional Review*, the journal of the Australian Concrete Association, reported that in the United Kingdom concrete was gaining a position of market dominance for high-rise construction due to the success of flat plate floor systems in multi-storey apartments.¹²⁸ In Australia, concrete slabs with flat undersides attracted interest at first in the residential sector,¹²⁹ but the field of applications expanded to some all-concrete office buildings. In-situ flat plate slab construction was used for example for the British-developed Communication House at the corner of Little Bourke and William Streets [map 1D, 35].¹³⁰ This concrete technology had the immediate benefit of providing easier ceiling

¹²⁷ "Concrete in Australia – The Revolution," *Constructional Review* 50, no. 4 (November 1977): 52-53.

¹²⁸ P. Arney and G. L. Glick, "Economics of a Multi-Storey Reinforced Concrete Building," *Constructional Review* 36, no. 3 (March 1963): 13-16.

¹²⁹ A. Whitting and D. Pearson, "Design of Flat Plate Floor for 'Kilburn Towers,' Manly NSW," *Constructional Review* 34, no. 7 (July 1961): 17-20.

¹³⁰ Communication House was developed by Muirfield Property Pty Ltd a subsidiary of the British Hammerson Group. "Communication House," *Constructional Review* 41, no. 4 (April 1968): 7-9.

fit out, but required dense internal columns and, as a result, it was confined to residential multi-storey construction or second tier office buildings.

In 1968, the state of the economic challenges faced by the Australian concrete industry was discussed in Canberra at the annual conference of the National Ready Mixed Concrete Association. On that occasion, cost consultant firm Rider Hunt reported the findings of a study based on data gathered from forty Australian multi-storey buildings.¹³¹ Rider Hunt's report concluded that, from an elemental cost perspective, all-concrete structural frames in Australia were significantly less expensive than concrete-encased steel structures. But the economic advantage of concrete was limited to buildings that did not exceed 25 storeys.¹³² Although data to establish the relative advantage of concrete over steel was scarce at the time, the study reported that buildings higher than 25 storeys would "tend to favour structural steel" as a more economical choice for primary structural construction.¹³³

The competitive advantage of concrete in multi-storey construction in Australia was deemed to depend from two main factors: firstly, the code requirement to protect steel against fire by encasing it in concrete; secondly the benefits brought by additional weight in structures to counterbalance wind loads. The dependence of steel to use concrete as a complementary material put therefore concrete in a position of "economic superiority" for "multi-storey structures of limited height and moderate span".¹³⁴ At the same time, addressing an audience of ready-mix contractors, Harry Wexler, the director and conference delegate of Rider Hunt, warned:

(...) the current economic superiority of reinforced concrete (...) may be only temporary, and (...) your counterparts in the structural steel world will soon be fighting hard to establish economic superiority of their product alone and not necessarily in conjunction with your own. Without painting too black a picture of the future, this is something you have to watch.¹³⁵

Post-tensioning

During the 1960s, concrete, despite economic potentials, was often the second-best choice for primary structural members in Australian tall building construction, as is evident

¹³¹ Harry Wexler, "Economic Aspects of Construction in Concrete," *Contracting and Construction Equipment* 23, no. 3 (March 1969): 11-14.

¹³² Wexler, 11.

¹³³ Wexler, 11.

¹³⁴ Wexler, 12.

¹³⁵ Wexler, 12.

particularly in Melbourne during the late 1950s and the 1960s [appendix F, table F18, F.19, F.20]. From the mid-1960s onwards, the Australian concrete industry faced tough competition from steel manufactures, and Australian concreters responded by investing and importing new technologies, which in turn broadened opportunities for high-rise applications with larger spans and diminished reliance on site labour. One of these new technologies, which had an important impact on office buildings, was concrete post-tensioning; a technology introduced in Melbourne in the 1960s from Switzerland.

In 1967, the Legal and General Building [map 6D, 32]¹³⁶ was built as one exposed all-concrete structure to form core, structural skeleton and facades. The concrete structure was reinforced externally with white mosaic tiles contrasted by recessed black bands. The use of concrete as the primary construction material was celebrated at the entrance in Collins Street, where a sculptural canopy of six post-tensioned concrete beams cantilevered 26 feet over the forecourt. The beams were one of the earliest applications in Australia of the Swiss-imported BBRV system of post-tensioning, a pioneering method based on a button headed wire tensioned with a multi-stage stressing program.¹³⁷

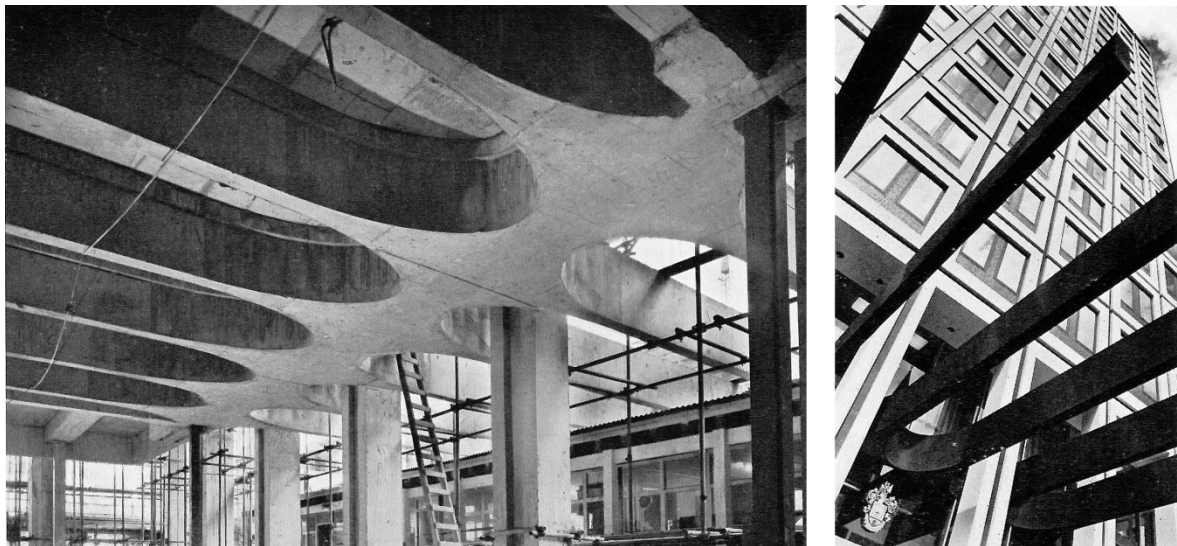


Figure 6.22

Legal and General Building, forecourt in Collins Street, sculptural canopy realised with post-tensioned concrete beams

¹³⁶ "Legal and General Building," *Constructional Review* 41, no. 6 (June 1968): 18-21.

¹³⁷ The BBRV system was an early post-tensioning method patented in 1948 by the Swiss company BBR, founded in 1944 by Max Birkenmaier, Antonio Brandestini and Mirko Robin Ros. <http://www.bbrnetwork.com/aboutus/history.html> (accessed 12 July 2015).

While the Legal and General Building used post-tensioning as a feature, tangible benefits in terms of space and construction in office buildings were experimented in a smaller office block, the Flotta Lauro Offices at 486-492 Bourke Street.¹³⁸ In this small multi-storey infill office block, completed in 1969, *in situ* post-tensioning was used to maximise floor space on a long and narrow parcel of land. Post-tensioning helped to achieve a column free space with net to gross floor plate efficiency of 82%. Post-tensioned T-shaped concrete beams were spaced at 8 feet centres and spanned up to 50 feet with an overall structural floor depth of 21 inches. External access for stressing of the tendons was precluded by the boundary walls. To resolve this, the post-tensioning contractor, the recently opened Australian branch of another Swiss company, VSL,¹³⁹ and the general contractor Sabemo, conceived the beams to stop short by two to three feet from the side walls; the rebate created on the underside of the floor was then used to access the tendons from the floor below for multi-stage post-tensioning.

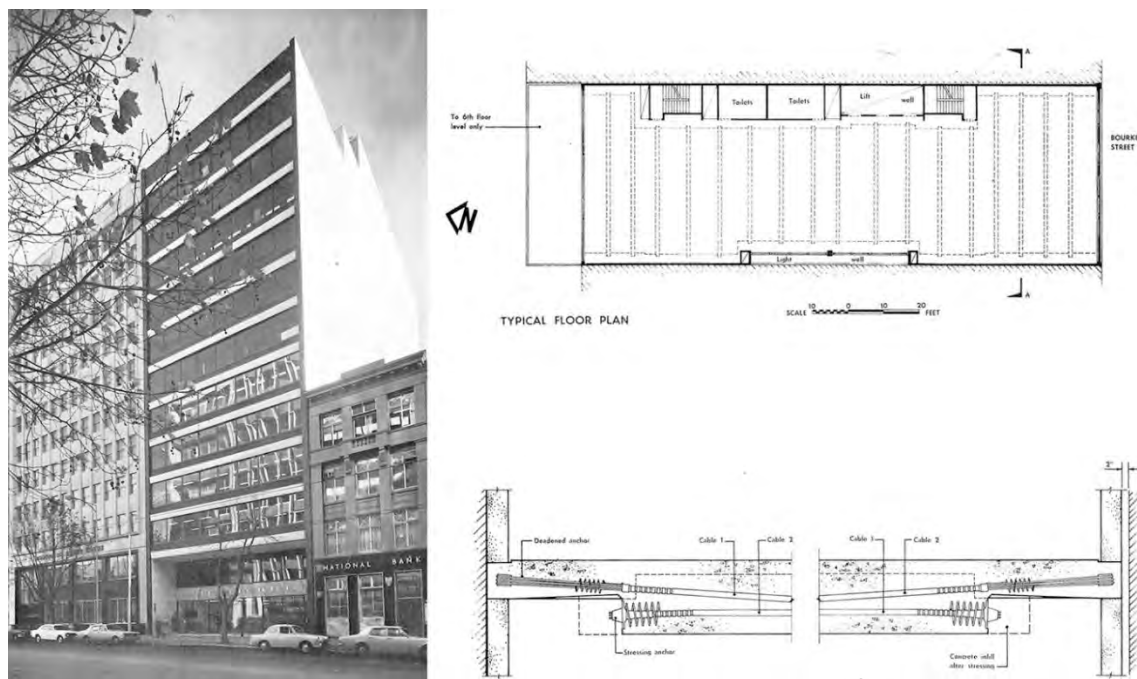


Figure 6.23

Flotta Lauro Building, 486-492 Bourke Street, 1966-70; external view, typical plan and cross section detail of the VSL post-tensioned floor

¹³⁸ "Column Free Offices on Narrow Site," *Constructional Review* 43, no. 3 (August 1970): 24-28.

¹³⁹ The VSL (Vorspann System Losinger) was an early post-tensioning method of Swiss origin, which became a worldwide recognised methodology since the late 1950s. In 1966 VSL expanded its network to Australia, creating VSL Australia. <http://www.vsl-australia.com.au/about-us/vsl-history> (accessed 12 July 2015).

Concrete mechanization

By the second half of the 1970s, the Australian concrete industry had progressed to an autonomous market position and as an independent alternative to steel for high-rise structures. In 1977, the frontispiece of a 50 years celebratory issue of *Constructional Review* highlighted this historical shift showing the all-concrete tower of MLC Centre under construction in Sydney's CBD. At that time, the MLC Centre was on its way to rise to a height of 244 metres as the tallest building in Australia and one of the tallest concrete structures worldwide.¹⁴⁰

Progress occurred due to technological advancements in several sub-sectors of the industry. Sophisticated methods of automatic vertical construction reflected advancements that grew with inputs from the American building industry. Lift-up slab construction methodologies, a further declination of the flat slab reinforced concrete floor type, were borrowed from the United States and used occasionally also in Australia. This method of construction found application both for residential construction, for example at Plaza 333 in St Kilda, Melbourne, and for commercial applications, for example at 1 Chandos Street in St Leonards, New South Wales.¹⁴¹

More enduring progress in concrete technology was achieved with self-climbing methods of formwork, in particular for service core construction. Concrete slip forming was introduced in Australian multi-storey construction in the early 1960s. Among the first methods of "moving" forms, the slip-forming technique that was used at first in Australia was based on systems such as the "Prometeo" or the "Sentab", which were diffused in the building industry by the company Concrete Silos Pty Ltd, a licensee of patented hydraulic jacking systems. Slip forming, as in the USA, was used first in the construction of industrial storage tanks and it was subsequently adapted to residential construction and in the erection of service cores for office buildings.

The first use of slip-forming in Australia was in 1961, in an apartment building complex known as "Tatlow Court" in Neutral Bay, Sydney.¹⁴² Another almost contemporary early

¹⁴⁰ *Constructional Review* 50, no. 4 (November 1977).

¹⁴¹ "New Horizons," *Constructional Review* 50, no. 4 (November 1977): 62.

¹⁴² "'Slipform' Formwork Sets New Pace in Building Erection Times," *Constructional Review* 34, no. 12, (December 1961): 16-18.

application of the same technique was used at the “Dorian Towers Home Units” in Double Bay, New South Wales.¹⁴³ Possibly, the first application of slip forming in office building construction was used for the service core construction of another two buildings in New South Wales: a building annex at the Bushell’s factory at Concord and Transfield House, in North Sydney.¹⁴⁴

Slip-forming remained the preferred method of formwork for in-situ concrete core construction in Australia during the 1960s and 1970s, but the technology was far from being immune from defects. In 1975 Hans Schmidt, a concrete technology inventor located in Doncaster, near Melbourne, filed a patent for a new apparatus for “progressively constructing” concrete walls, later to be known in the industry as the “jump form” system.¹⁴⁵ At the background of Schmidt’s invention were a number of disadvantages and problems experienced locally with slip-forming. Some of the most significant problems were associated with difficulties in controlling the thickness of walls due to fluidized concrete pressures and due to problems of roughness and defects of the concrete face caused by the continuous slipping of the forms.

The new method of mechanically moved formwork used proprietary hydraulic jacks to shift vertically - or “jump” rather than “slide” – an apparatus of formworks and platforms that was generally set to correspond to one floor height. The benefits of this new method were considerable because it allowed substantial acceleration of vertical concrete construction. Jump forms were conceived to be operated by “personnel with normal trade experience”.¹⁴⁶ Jump forming, in summary, reduced on-site labour, eliminated entirely or reduced significantly dependence from crane lifting requirements in core construction and allowed better quality control and vertical alignment.¹⁴⁷

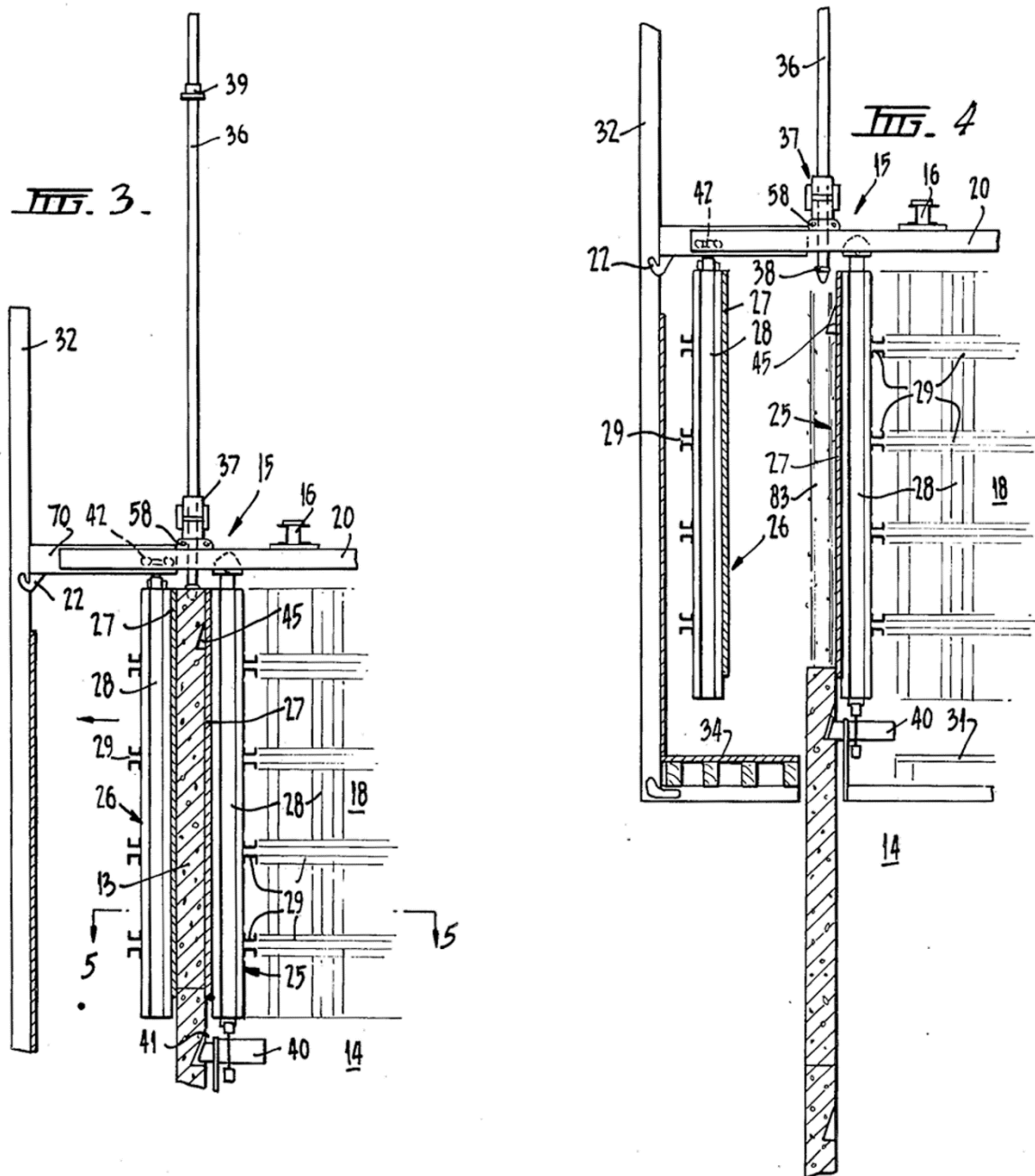
¹⁴³A. Whitting and D. Pearson, “Innovation in Slip Form Construction,” *Constructional Review* 35, no. 12 (December 1962): 14-16.

¹⁴⁴ W.M. Newman, “The Use of Moving Forms in the Construction of Concrete Service Towers for Multi-Storey Buildings,” *Constructional Review* 35, no. 6 (June 1962): 22-27.

¹⁴⁵ Hans Heinrich Schmidt, “Method for Progressively Constructing a Wall of Cementitious Material,” United States Patent 4016228, 5 April 1977.

¹⁴⁶ Schmidt, 50.

¹⁴⁷ Schmidt, 50.

**Figure 6.24**

Hans Heinrich Schmidth, original patent drawings of mechanized concrete formwork apparatus, also known as "jump form", 1977

By the mid-1980s three systems of self-climbing form, other than slip-forming were widely accepted in the Australian building industry.¹⁴⁸ The first was the "Supershafter"

¹⁴⁸ "Climbing Forms," *Constructional Review* 57, no. 1 (February 1984): 30-37.

system patented by Civil and Civic,¹⁴⁹ which combined one floor-high climbing forms with the use of cranes for lifting the equipment to the next pouring height. The other two systems were entirely independent from crane lifting. The VSL system consisted of a peripheral platform lifted to the next height by rams located inside the shaft,¹⁵⁰ and the third system, evolved from Schmidt's 1977 patent, was the "Fabquip Jumpform",¹⁵¹ and it was the most efficient and popular among the three. It consisted of platforms lifted by stationary jack rods that used a new proprietary type of "climbing jacks" known as "Lubeca". The climbing jacks lifted formwork to a new level stabilised with "shear-key" connections and were supported directly by the core wall completed earlier at a lower level.¹⁵²

Breaking the 25-storey barrier

In the late 1970s, concrete started to gain a competitive edge against steel as demonstrated by the completion of the 46-storey storey high Capital Tower – later known as National Bank House - in Bourke Street [map 2C, 58]. The all *in-situ* structure of the tower was conceived with four mega-corner columns tied together by ring beams at plant room levels. Slim mullions were then cast for the intermediate concrete floors, and the vertical loads were transferred to the corner columns by six metre-deep ring beams, which were post-tensioned using a BBR patented system.¹⁵³ This structural solution, unprecedented in Melbourne, was designed by the London office of Arup and Partners in view of reducing construction time to a minimum.¹⁵⁴

This approach to large span transfer and corner-only support exposed the engineers to a range of problems of dimensional control due to drying shrinkage, an inherent challenge of tall concrete structures. The entity of concrete shrinkage was augmented by the separation between the external mega-frame and the inner core. Relative movement between the main external structure and the core were accommodated with bearing seats of the ring beams

¹⁴⁹ "Climbing Forms," 36-37.

¹⁵⁰ "Climbing Forms," 32-33.

¹⁵¹ "Climbing Forms," 34-35.

¹⁵² Following from the initial patent filed in 1977, Melbourne-based inventor Hans Schmidt refined the "jump form" method of construction and filed another two international patents: "Climbing Jack", United States Patent 4032112, 28 June 1977; "Building Construction System," United States Patent 5263835, 23 November 1993, assigned to Lubeca Construction Systems, Victoria, Australia.

¹⁵³ "National Bank House," *Construction Review* 51, no. 4 (November 1978): 54-60.

¹⁵⁴ John Davidson, interview, 28 November 2014.

over the corner columns and by Freyssinet hinges used at the lowest section of the intermediate floor mullions.¹⁵⁵

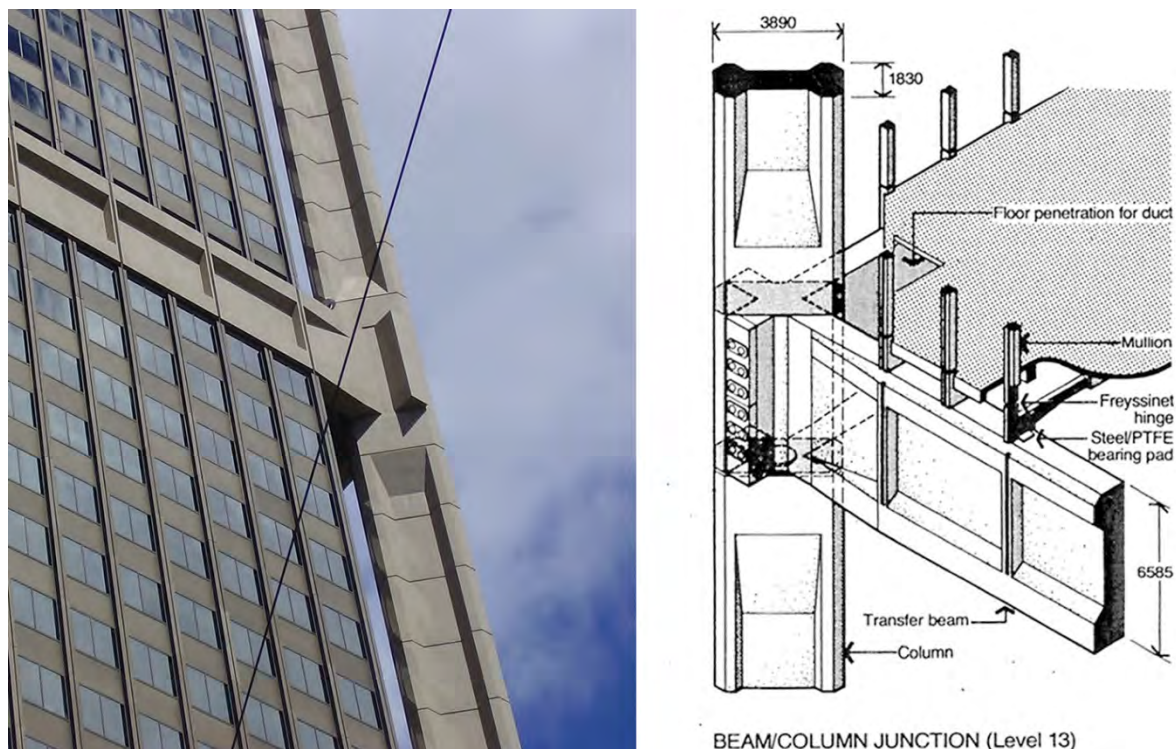


Figure 6.25

Capital Tower / National Bank House, external view and isometric diagram of junction between corner mega-columns and post-tensioned transfer ring beams

Nauru House [map 8A, 56] was built as an all in-situ structure that married the corner-only support of Capital Tower with the tube in tube structural concept of Collins Place. The tower had sixteen columns concentrated in the vertices of an octagonal plan. The external tube was defined horizontally by densely spaced spandrel beams of exposed concrete, which acted as permanent formwork of the edge beams. Nauru House was in concept - and in appearance - very similar to the MLC Centre, which was being erected almost simultaneously by the same builder, Civil and Civic, in Sydney. In 1976, *Constructional Review* reported that the latter was conceived after consultations with “leading structural engineers in the USA”.¹⁵⁶ These consultations referred to input from Fazlur Khan of Skidmore Owings and Merrill and Mark Fintel of the Portland Cement Association. Khan

¹⁵⁵ “National Bank House,” 59-60.

¹⁵⁶ “Nauru House,” *Constructional Review* 49, no. 4 (November 1976): 27-31.

and Fintel had primary influence in the conception of the horizontal tube of the MLC Centre in Sydney, where they worked in collaboration with Harry Seidler, the architect, and structural consultant Pier Luigi Nervi.¹⁵⁷

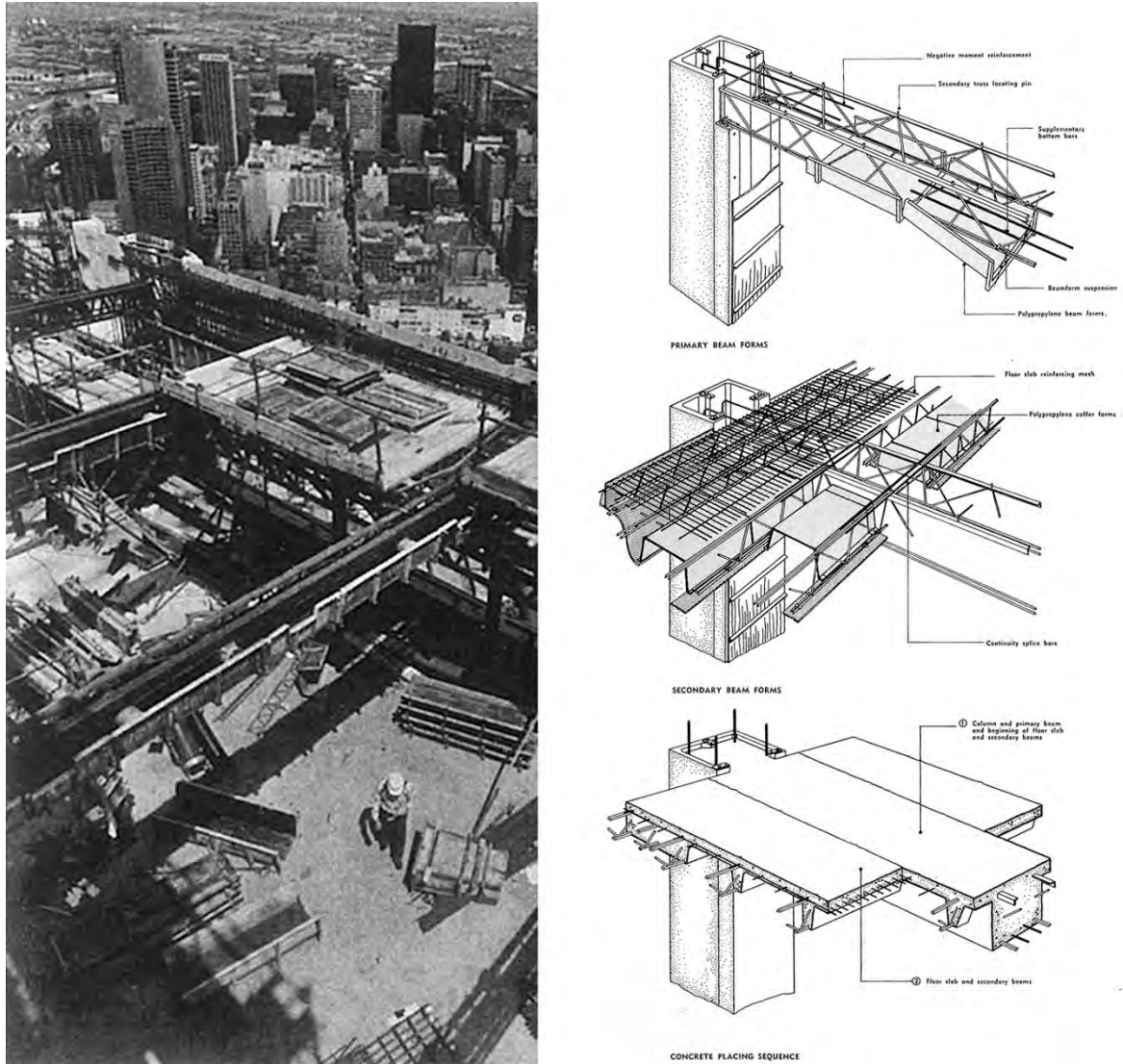


Figure 6.26

Nauru House, view under construction and sequential diagram of “Progressive Strength” floor construction system

The floors of Nauru House were built using an innovative method of construction patented by Civil and Civic in the early 1970s: the “Progressive Strength” system.¹⁵⁸ The method consisted of a multi-staged pouring of the floor structure, where steel reinforcement for

¹⁵⁷ “M.L.C. Project,” *Constructional Review* 47, no. 1 (February 1974): 10.

¹⁵⁸ “Progressive Strength: a Development in Concrete Construction,” *Constructional Review* 45, no. 3 (August 1972): 14-15.

primary beams was installed in the form of self-supporting trusses that in turn supported, without propping, wet concrete for the primary beams. Subsequently, the same technique was used for the pouring of secondary beams and slab construction. The progressive strength system enabled faster and more economical floor cycles in clear span multi-storey concrete slabs. It allowed work to be carried out simultaneously on four different levels due to the lack of a “forest” of temporary propping, which was normally associated with flat-slab concrete construction. Nauru House achieved a floor cycle of five days and the finishing trades were able to be carried out within six floors of the topmost floor under construction.¹⁵⁹

Concrete-rising

In Melbourne, the completion of Capital Tower and Nauru House demonstrated that tall office buildings could also be built well-above the threshold of 25 storeys. The two projects signalled that the conceptual reservations about the economic feasibility ascribed to all-concrete tall buildings had been overcome. During the 1980s, the advancements in concrete technology that were developed in the 1960s and 1970s started to be applied more systematically in Melbourne’s skyscrapers.

The jump-forming method of concrete core construction was used for the first time on a large high-rise structure at the State Bank Centre project at the corner of Elizabeth and Bourke Street in Melbourne [map 6B, 60]. The building was conceived in the early 1970s,¹⁶⁰ but it was completed only a decade later, in 1982. Construction started in 1976 but significant delays were caused by industrial disputes.¹⁶¹ The primary loadbearing elements of the building formed a tube in tube structure where the lateral stability of the core was augmented by an external rigid frame formed by deep spandrel beams and concrete columns at 2.84 metre centres. Light-weight composite concrete-steel floors spanned between these primary concrete elements of the tower.¹⁶² Two-storey high concrete trusses at levels 3 and 4 transferred the external tubular concrete frame to four large corner columns, which thus created a large column-free open space at street level – a solution very similar to the one used by Nauru House and National Bank House.

¹⁵⁹ “Nauru House,” *Constructional Review* 49: 28.

¹⁶⁰ “43-storey State Bank Centre,” *Architecture Today* 14, no. 9 (October 1972): 9.

¹⁶¹ “State Bank Centre,” *Constructional Review* 58, no. 2 (May 1985): 14-17.

¹⁶² “State Bank Centre,” 15.

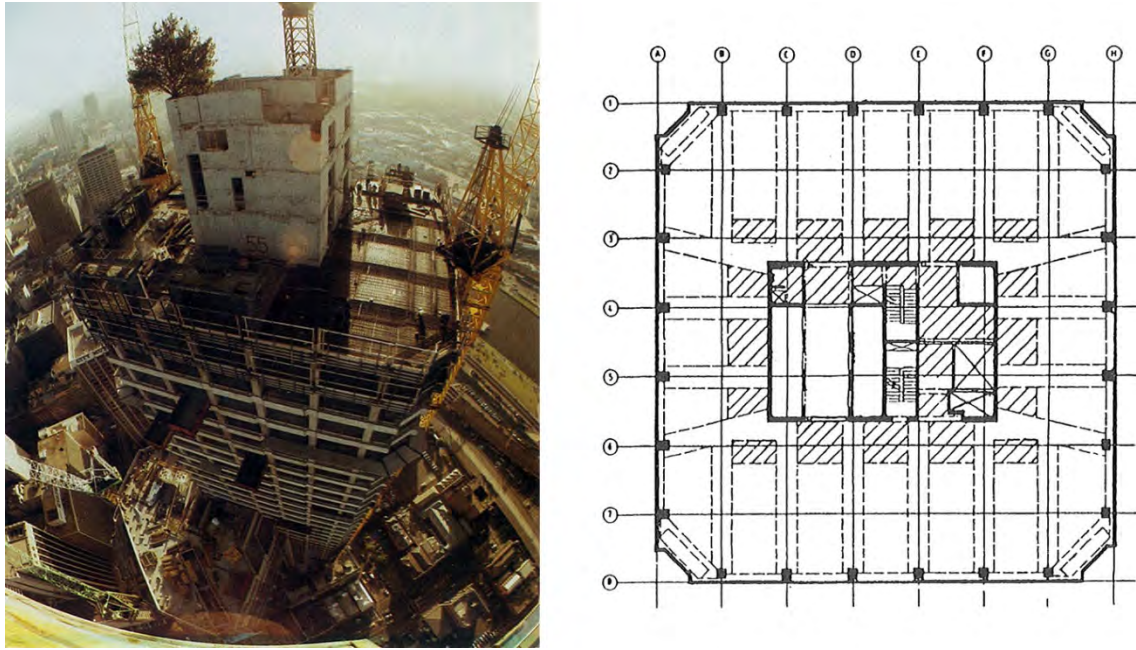


Figure 6.27

Rialto towers, concrete core “topped out” seen from crane bucket in December 1984 and structural layout of typical sky rise floor

The all-concrete structural approach was used for the construction of Rialto, the first building to break through the two-hundred metre height mark in Melbourne [map 5D, 64]. The construction methodologies of Rialto were tried before by the local head contractor, Grocon, with structural engineers Meinhardt Australia and the architect Gerard De Preu, in the smaller office development of the new ACI House at 200 Queen Street [map 2D, 61]. The structural typology used for Rialto was a tube in tube structure of column-free space with 500 millimetre deep concrete band beams spanning between the external frame and a jump-formed core. The construction of the concrete floors was completed efficiently on work cycles of six days using a methodology based on large “flying” or “table” forms lifted by crane.¹⁶³ A total of 53 different types of forms, some of which up to 11 metres long, were used for the construction of 65 floor slabs. A typical table was made with hinged sections forming the sides and soffit of beams. Forms were put in place with the aid of a custom built rubber-tyred vehicle that was equipped with hydraulic rams. Subsequently, the tables were propped with square hollow section supports on telescopic legs and after the pour they were “flown” by crane to the next level.

¹⁶³ “Flying Forms,” *Constructional Review* 57, no. 2 (May 1984): 52-53.

An important novelty for the Australian construction industry was introduced at Rialto: the Otis “Jump Lift”. Before Rialto, the most common option available to transport workmen and materials in multi-storey construction was to use a temporary hoist attached to the external edge of the building. External hoists, however, normally prevent the external envelope to be sealed off entirely before the very last stages of the project, when the hoist is finally dis-assembled by a recovery crane. The concept of the “jump lift” allowed hoisting to occur directly inside the passenger shafts of the core during construction. Subsequently these temporary hoists, which were equipped with cars travelling at 2.5 metre per second, were “jumped” hydraulically upwards – like in formwork construction – as the construction of the core progressed, while the lower parts of the shafts could start to be fitted with the passenger lifts.¹⁶⁴

Significant local skills in concrete high-rise design and construction were also demonstrated at Rialto. The asymmetric layout of the building posed significant challenges of stability and furthermore, as a 240-metre tall structure, it posed significant problems of creep and shrinkage. The engineers, using computer software imported from the United States, calculated that non-elastic shortening of up to 200mm would occur in the tower. In some locations, due to the configuration of two towers with different heights, some adjacent columns were estimated to have 40mm differential shortening. These problems were resolved with an innovative application of post-tensioning. The shorter tower was induced to shrink more than it would otherwise via elastic compression. Vertical tendons were installed, stretching from level 38 down to level 1, and they were stressed in four stages as the construction of the taller tower progressed past level 38. With this unusual large scale application of vertical post-tensioning, differential shortening between nearby columns of the two towers was reduced within acceptable levels of serviceability.¹⁶⁵

¹⁶⁴ Geoff Morrin, “Rialto’s Vertical Transportation System,” *Building Product News* (August 1985): 14.

¹⁶⁵ “Rialto Building, Melbourne, Australia,” in Kowalczyk, Sinn and Kilmister [eds], *Structural Systems for Tall Buildings*, 285-289.



Figure 6.28

Rialto towers, all-concrete tube in tube and reflective glass curtain wall under construction, 1985

Concrete-dominant

In the late 1960s, post-tensioning in Australia was a technology in its infancy, particularly if considered as an application to multi-storey commercial construction. But during the 1970s, and even more during the late 1980s, post-tensioning held an important role to help the competitive development of the Australian concrete industry. Floor slab post-tensioning in particular, alongside the locally conceived jump-form method of construction were the two emerging technologies that contributed to consolidate the competitive nature of all-concrete high-rise construction in Melbourne.

In the late 1980s, an all-concrete approach of tube in tube and post-tensioned floor slabs was used for the erection of Bourke Place [map 1D, 68], which allowed the contractor, Civil and Civic, to proceed ahead of schedule. The post-tensioned beams spanned 11 metre from core to edge beam and they were rebated at their ends allowing post-tensioning to occur from their underside. This solution - similar to the one introduced in Melbourne in the 1970s by the Flotta Lauro Building - facilitated the layout of two rings of mechanical ducts, which could run relatively unobstructed in the ceiling space along the perimeter and along the core of the building.¹⁶⁶

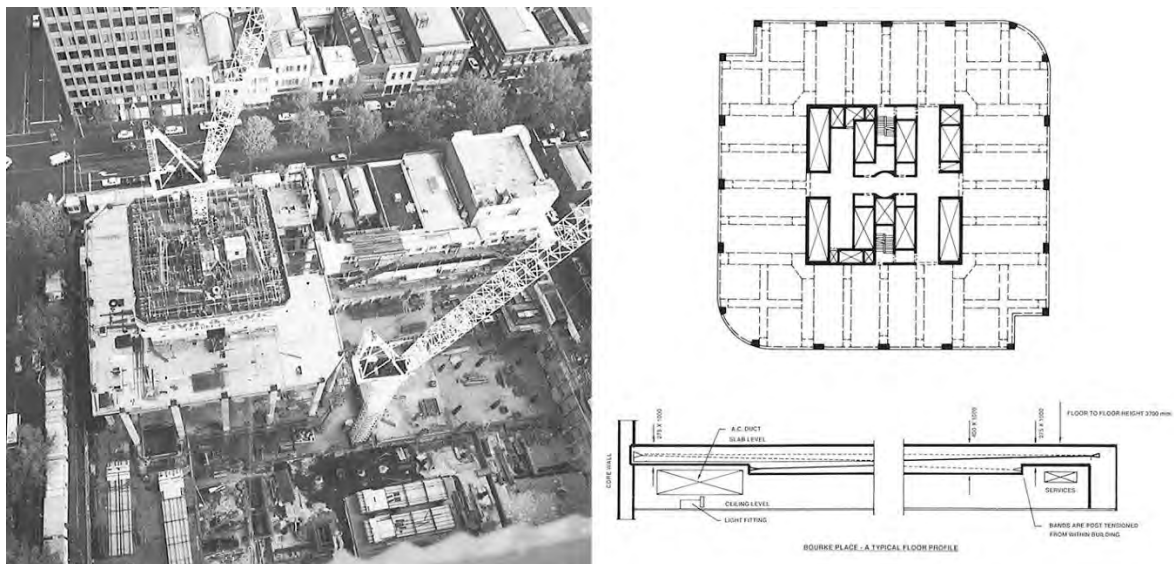


Figure 6.29

Bourke Place, aerial view of construction site, structural layout of typical floor and profile of post-tensioned floor system

¹⁶⁶ "Bourke Place," *Reinforced Concrete Digest* 4 (June 1988) [monographic issue].

At 120 Collins Street, the external tube was framed *in situ* with hydraulically lifted formwork. The structure was completed by composite steel floor frames supported at their inner side by a jump-formed service core. Some construction management challenges were overcome by the head contractor Grocon with a technological control of jump-forming.¹⁶⁷ A design change was prompted by BHP, the anchor tenant of the project, which required raised floors for a number of levels at the low-rise section of the tower. This change caused significant delays, economic pressures and further complications during the erection of the tower. But speed of construction and independence from other trades of the jump-forms allowed the contractor to remain on track and claim cash flow by pushing the construction of the core ahead of schedule. During some stages of the construction, the core preceded the erection of the external frames by up to 30 floors while work on the podium lagged behind held by design changes. Significant issues of differential settlement arose when the concrete core settled lower than expected in relation to the external frame. These issues were subsequently resolved during construction with the redesign and resetting of steel supported floor construction.¹⁶⁸

Some perceptions of the competitive advantage of steel as a primary structural material for high rise construction re-emerged by the early 1990s, but the market appeal of the concrete industry remained in a dominant position in Melbourne. This was particularly due to the leading market share held by the local contractor Grocon that developed and maintained a strong expertise in concrete construction in Melbourne and in Australia. The new headquarters of the ANZ Bank at 100 Queen Street were initially conceived as a steel frame structure to be complemented by a concrete side core. After winning the project, Grocon was able to re-engineer the structure, changing the initial concept of steel to an all-concrete solution that brought significant savings in the overall cost.¹⁶⁹ All-concrete structural construction was used also by the same builder for the Telecom Centre in Exhibition Street, where a concrete tube in tube was built in combination with partially

¹⁶⁷ Steven Richardson, "Constructing 120 Collins Street, 23 Years Later," lecture in Advanced Construction Technology, 3 August 2015, Melbourne School of Design, University of Melbourne.

¹⁶⁸ Richardson, lecture, 3 August 2015.

¹⁶⁹ Richardson, lecture, 3 August 2015.

pre-stressed band beams, and where the use of table forms allowed, in some instances, a floor to floor construction cycle of three days.¹⁷⁰

Conclusion

After WWII, significant knowledge-transfer in construction technology spread from North America to the Australian building industry. In some instances, new developments had direct ties with those of the USA; but in other respects Australia developed from foreign inputs an autonomous approach in the quest for all-round efficiency in tall office building design and construction.

Technical developments in air conditioning in Australia followed closely those of the USA. After World War II, strategic innovation in air conditioning systems were developed to maximise efficiency on different fronts: the efficiency of white-collar employees in the workplace, plant efficiency in order to minimise energy cost in operation, and a broader all-round building efficiency seeking less spatial requirements, as in the case of high-velocity dual duct systems. The benefits of these innovations were quickly received by Australian designers; but in Melbourne, at first, the provision of ‘full’ air conditioning was questioned by building owner-occupiers who raised doubts on reliability and cost-value benefits. Systems changed and developed considerably between the 1950s and the mid-1960s until the introduction of variable air volume systems, which simplified the design of ceiling-only air distribution, while giving optimised sizing of plant that translated into less energy use. Ultimately, new air conditioning systems were adopted in tall office buildings whenever tangible progress was made on matters of reliability, adaptability to multi-zoning, flexibility in operation and reduction of first and running costs.

In Melbourne, despite difficult rental market conditions during the 1970s, skyscrapers continued to be built in a volatile technological environment, where plant typologies changed drastically over two decades, thus exacerbating difficulties for building owners to assess the effective economic benefit of air conditioning in office buildings. But if in the early 1960s the cost-value benefit of air conditioning in the city was still a matter of debate, in the 1970s, air conditioning was recognised as vital for rentability. Interests

¹⁷⁰ “Telecom Corporate Building, Melbourne, Australia,” in Kowalczyk, Sinn and Kilmister [eds], *Structural Systems for Tall Buildings*, 137-139.

shifted therefore from the question of ‘if’ to control artificially the climate to the question of ‘how’ to do so in the most efficient way. The problem of air conditioning was therefore considered holistically in the design of tall office buildings, where matters of cost in operation were directly connected with aspects of the architectural design, such as floor plan size and shape, façade materials and amount of fenestration.

A similar approach of holistic integration of building services and façade technology was applied between architectural form and structural engineering, where optimal technical solutions were searched for in response to problems of clear span, speed of construction and resistance to lateral loads.

After a slow-start due to severe steel scarcity after WWII, the Australian steel industry consolidated its high-rise market position by fine-tuning technologies introduced in the post-war years, namely structural welding, stud-welding and composite flooring. Notwithstanding the remarkable achievements in steel technology demonstrated by BHP House, in Melbourne local expertise on concrete high-rise construction started to grow considerably during the 1970s.

Advancements in concrete technology combined the break-through invention made in Melbourne of “jump-formed” automated formwork with post-tensioning techniques borrowed from Switzerland and the use of high-strength concrete mixes. The combination of these technologies allowed the concrete industry in Melbourne to gain a local character of difference and to emerge as a world-leading centre of all-concrete high-rise construction, which in turn relegated local steel-framed construction to the subordinate role of complementary material in composite structures.

A general approach towards heterogeneous composite structures characterised the rest of the construction methods used on most tall office buildings completed in the CBD, where often concrete-heavy core construction and fire-safe encasements went hand in hand with fast-erected perimeter frames and steel deck construction. But overall, after breaking a conceptual barrier of economic feasibility in high-rise structures of 25 floors, heavier and rather massive all-concrete construction technologies became the preferred choice in Melbourne’s skyscrapers from the 1970s until the 1990s.

In 1975, Howard Tanner was right to recognise the destructive impact of some American inspired skyscrapers on the streets of Melbourne. But the critic missed to appreciate, or perhaps understand, that behind a post-modern biased and skin-deep assessment of the aesthetics of 'glass and metal', the very same skyscrapers, and many other tall buildings in Melbourne at that time, were test-beds and conveyors of major technological developments for the Australian construction industry. Their simple formal outcomes were a stage in a pattern of evolution that stemmed from concerns of all-round efficiency in design, construction and operation, including problems of energy consumption and comfort for their occupants.

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Chapter 7

American *dé-jà vu* (1945-1985)

The rise and fall of the international square tower

I am interested in shape, damn it, *shape*. And I'll tell you why. I am interested in shape, basic prismatic shape, because it lets you get right away to the core of what big office buildings are about – wrapping up the required amount of space in as economical a skin as possible, doing so in such a way that people will want to identify themselves with the building by renting some of that space.

Philip Johnson, 1976¹

The transfer of structural, service and façade technologies from America to Australia was a major influence for the genesis and evolution of tall office buildings in Melbourne. Personal relationships and contacts between American and Australian architects and the iconographic “mediation” of American architecture through periodicals of architecture were equally important for the growth of tall buildings and, more in general, for the diffusion of modernism in Australia after WWII.² The role played by the socio-aesthetic component of Americanism in Melbourne's skyscrapers should not be underestimated, and it is difficult to isolate matters of architectural trends and aesthetics from those of economic efficiency and technological change discussed so far. The direct influence of American architects was significant for many large scale projects in Australia, where Australian architects and clients worked side by side with American architects.³ Among the many instances of such influences and collaborations on large scale projects some episodes related to the tall office building in Melbourne.

In Melbourne, in 1957, the client's representative of the Colonial Mutual Life Society directed the architect, Stephenson and Turner, to search in the latest issues of *Architectural Forum* and *Architectural Review* for the visual models to “treat” the elevations of the new

¹ Quoted in William Marlin, “Pennzoil Place,” *Architectural Record* 160, no. 6 (November 1976): 110.

² Paul Hogben, “Architecture and Arts and the Mediation of American Architecture in Post-war Australia,” *Fabrications: Journal of the Society of Architectural Historians*, Australia and New Zealand 22, no. 1 (2012): 30-57.

³ Philip Goad, “Importing Expertise: Australian-US Architects and the Large-scale, 1945-1990,” *Fabrications* 23, no. 3 (November 2016): 357-391.

CML Headquarters in Collins Street.⁴ Among the sources of reference proposed by the client, which were specified complete of page numbers, a 20-storey office slab on a black colonnaded podium in Dallas - the headquarters of the C.J.C. Realty Company – may have captured, above all, the attention of the design team of Stephenson and Turner.⁵

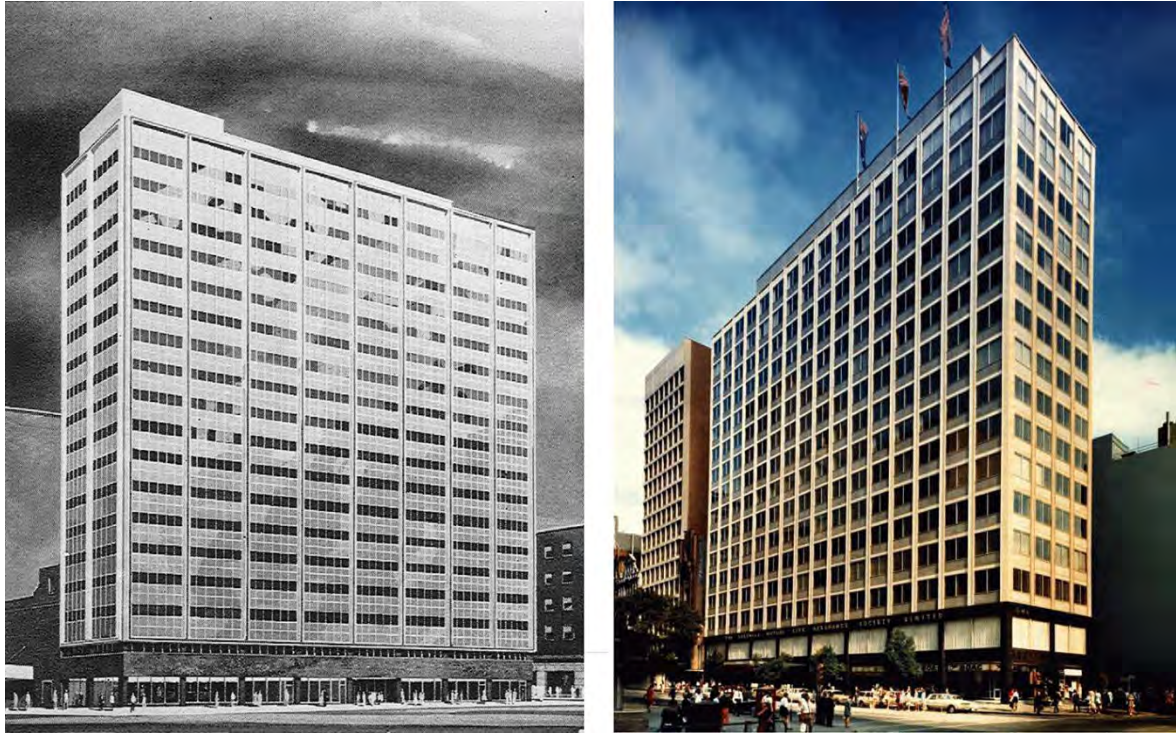


Figure 7.1

C.J.C Realty Company Building, Dallas, 1957 (left) and Colonial Mutual Life Building, Melbourne, 1957-63

Inspiration from American tall office buildings was gathered also by direct observation. Osborn McCutcheon saw the Inland Steel Building, possibly under construction or during the design phase, after a personal visit at the office of Skidmore Owings and Merrill, and he is credited to have used the side core building in Chicago as the reference model for the typology of ICIANZ House in Melbourne.⁶

Prolific contacts of exchange occurred with between Australian and American firms across the Pacific, before and after WWII. The director of Stephenson and Turner, Arthur

⁴ SLV, Stephenson and Turner Archives, volume 3278, CML-1-2A, 1956-57, Stephenson and Turner Architects, memorandum of telephone conversation with Mr E.W. Curtis [Colonial Mutual Life Society] and J.H. Melville [Stephenson and Turner Architects], 18 September 1957.

⁵ "Sidewalk Setback," *Architectural Forum* 107, no. 1 (July 1957): 39.

⁶ Rico Bonaldi, interview, 1 September 2014.

Stephenson, for example, held correspondence with Welton Becket, and one ex-employee of the Melbourne firm was employed in Becket's office in Los Angeles in the mid-1950s.⁷ Soon after World War II, steel shortages and building permit restrictions that lingered from the war prevented large construction projects in Australia. These conditions prompted many young architects to expatriate to the United Kingdom and to the USA in search for work.⁸ Expatriation for work continued over the 1960s, but many Australian architects considered experience overseas as a spring-board to return at home with better skills, knowledge and career prospects. Among these temporary migrants, architect Robert Bruce acquired experience at the San Francisco office of Skidmore Owings Merrill, before returning to Melbourne to become director of Bates, Smart & McCutcheon (BSM) in 1970. Bruce worked at SOM on the AMP Square project, alongside another young Australian architect, Daryl Jackson, who was on his way back to Australia after a period of work in the American East Coast for Paul Rudolph.⁹

The flow of architectural ideas from America reached Melbourne also with the direct involvement of leading American architects. In the late 1950s, the design of the office block of Shell Corner was commissioned to the San Francisco Office of SOM, at the time under the direction of John Barney Rodgers. The good reputation of SOM San Francisco in Melbourne continued in the 1960s, when the executives of the Australian Mutual Provident Society nominated the team lead by Chuck Bassett to design AMP Square.¹⁰ Decisive for choosing SOM San Francisco was the impression that AMP executives received from a project designed in Sydney by the Californian branch of SOM, the fully air conditioned Qantas Wentworth Hotel.¹¹

⁷ SLV, Stephenson and Turner Archives, volume 1047, Mr E. R. Ballantyne Investigations in U.S.A. into Glass Cladding of Buildings, October to December 1956. Arthur Stephenson, letter to Welton Becket, 1 November 1956. Welton Becket later had the opportunity to design the high-rise hotel of the Southern Cross in Melbourne. "Southern Cross Hotel," *Constructional Review* 35, no. 9 (September 1962): 16-20.

⁸ John Davidson, interview, 28 November 2014.

⁹ Daryl Jackson, interview, Melbourne, 11 September 2014; Philip Goad, "Moderate Modernism: 1945-77," in Philip Goad [ed.] *Bates Smart: 150 Years of Australian Architecture* (Fishermans Bend, VIC: Thames and Hudson, 2004), 198, 203.

¹⁰ Richard Foster, interview, 11 December 2013.

¹¹ Paul Hogben, "Double Modernity: the First International Hotels," in *Leisure Space: the Transformation of Sydney, 1945-1970* (Sydney: New South, 2014), 64-68; "Qantas Hotel, Sydney," *Architecture and Arts* 13, no. 1, (January 1965): 18-19; "Air Conditioning and Refrigeration at Qantas, New Wentworth Hotel in Sydney," *Australian Refrigeration, Air Conditioning and Heating* 21, no. 7 (July 1967): 27-28, 37-40.

In the late 1960s, during the initial stages of the BHP House project and after following advice from AMP, BHP considered to engage the same team of architects of AMP Square, including BSM as local architects. Discussions between BHP and BSM followed, but given McCutcheon's imminent retirement and reluctance to stay as director in charge of the project, BHP preferred to engage locally Yuncken Freeman. While seeking to design what needed to outshine the nearby tower of AMP, director Barry Patten decided to engage SOM Chicago as consultants, and not SOM San Francisco, to avoid outcomes that may resemble too closely AMP Square.¹² While assisting Yuncken Freeman in the development of the structural concept of BHP House, SOM Chicago held a vital role in the project.¹³

The grandeur of Collins Place was such that the joint-owners of the development, ANZ and AMP, felt appropriate to follow praxis, as established by AMP Square and BHP House, to delegate the design of record breaking skyscrapers in Melbourne to American architects. On ANZ's suggestion, the New York-based firm of I.M. Pei and Cobb was selected for the job.¹⁴ Pei and Cobb were flanked by a concept-design team of American consultants that included Vincent Ponte (planning), Weiskopf and Pickworth (structural), Cosentini Associates (services) and Travers Associates (traffic). A local team, headed by BSM as local architects and planning consultants, was put in place to mirror the team of American experts.

Less directly, some influence was exercised in Australia by the purist tall building projects of Minoru Yamasaki. In 1964, the World Trade Center and the IBM Building in Seattle were publicised in Australia,¹⁵ and in 1971, Yamasaki visited Australia with a tour of public lectures in Perth, Melbourne and Sydney. Yamasaki's tour was sponsored by Alcoa to present American projects where innovative uses of aluminium were showcased, including those in the signature and ground-breaking skyscraper project of the World Trade Center in New York.¹⁶

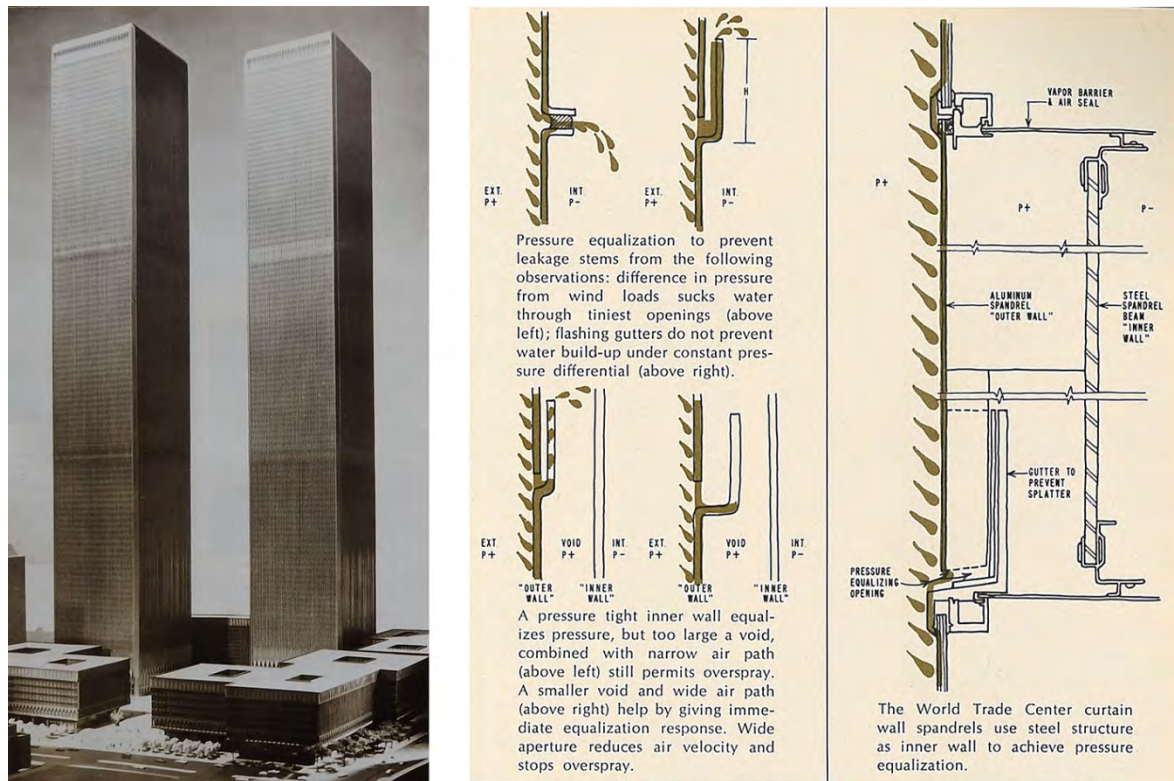
¹² Rico Bonaldi, interview, 1 September 2014.

¹³ Peter Corrigan, "The BHP Building," *Architect* 3, no. 41 (May 1976): 16-17; Philip Goad, "BHP House, Melbourne," in Jennifer Taylor, *Tall Buildings, Australian Business Going Up: 1945-1970* (Sydney: Craftsman House, 2001), 260-281.

¹⁴ Rico Bonaldi, interview, 1 September 2014.

¹⁵ "Twin Towers: World's Tallest," *Architecture Today* 6, no. 7 (May 1964): 17-19.

¹⁶ "Renowned Architect's Philosophy," *Architecture Today* 13, no. 10 (November 1971): 14-15.

**Figure 7.2**

World Trade Center, New York; model and explanatory diagrams of pressure equalised aluminium façade system developed by Alcoa, 1965

In 1977, the journal of the Western Australian Chapter of the RAI A presented a visual commentary that hinted with irony at a “*dé-jà vu*” of American buildings in Australia, showing among others pictures side by side of the Bank of America World Headquarters¹⁷ and Allendale Square in Perth.¹⁸ The visual comparison touched on superficial analogies between the two zig-zag façades, although it missed to point out critical differences of material and plan shape.¹⁹ The faceted envelope of Allendale Square, designed by the Perth-based firm of Cameron Chisolm and Nicol, was widely publicised in Australian periodicals as a tipping point for the development of Australian skyscrapers.

¹⁷ The Bank of America tower, completed in 1969, was designed by the joint venture of Skidmore Owings Merrill, Wurster Bernardi and Emmons, and Pietro Belluschi. “The Sculptural Expression of Tradition in San Francisco,” *Architectural Record* 148, no. 1 (July 1970): 126-132.

¹⁸ “*Dé-jà vu*,” *Architect W.A.* 16, no. 1 (1977): 30-31.

¹⁹ The Bank of America was rectangular and clad in red granite, Allendale Square was clad in aluminium and it was a square plan tower with central core.

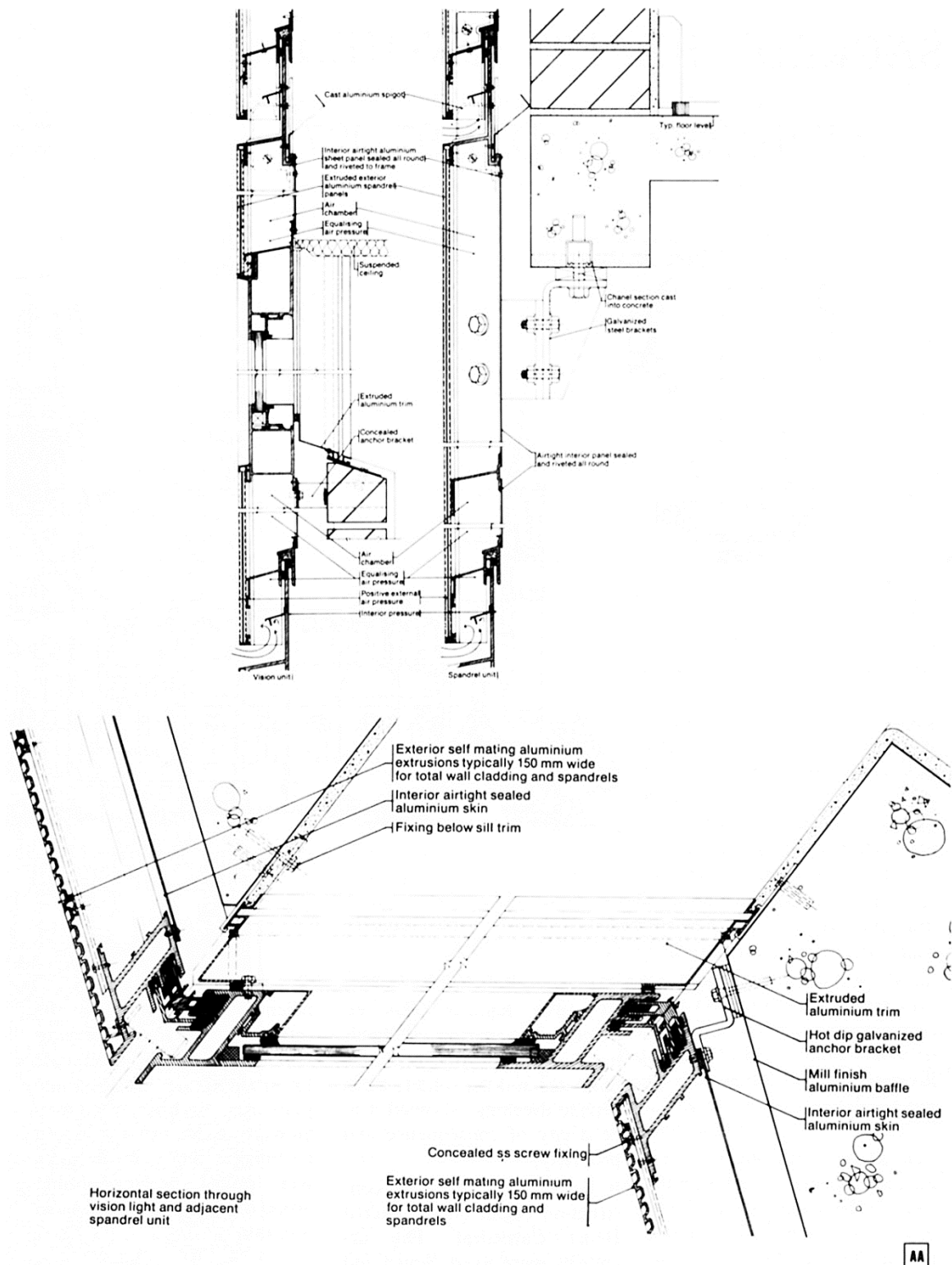


Figure 7.3
Allendale Square, Perth; construction details of pressure equalised aluminium façade system, 1977

The building was a new technological paradigm that used, at a large scale, two strategic innovations of American origin: variable volume air conditioning and pressure equalised aluminium curtain walls.²⁰ The latter was borrowed directly from Yamasaki's Twin Towers in New York, where Alcoa had developed and applied for the first time the new open joint methodology of waterproofing.²¹

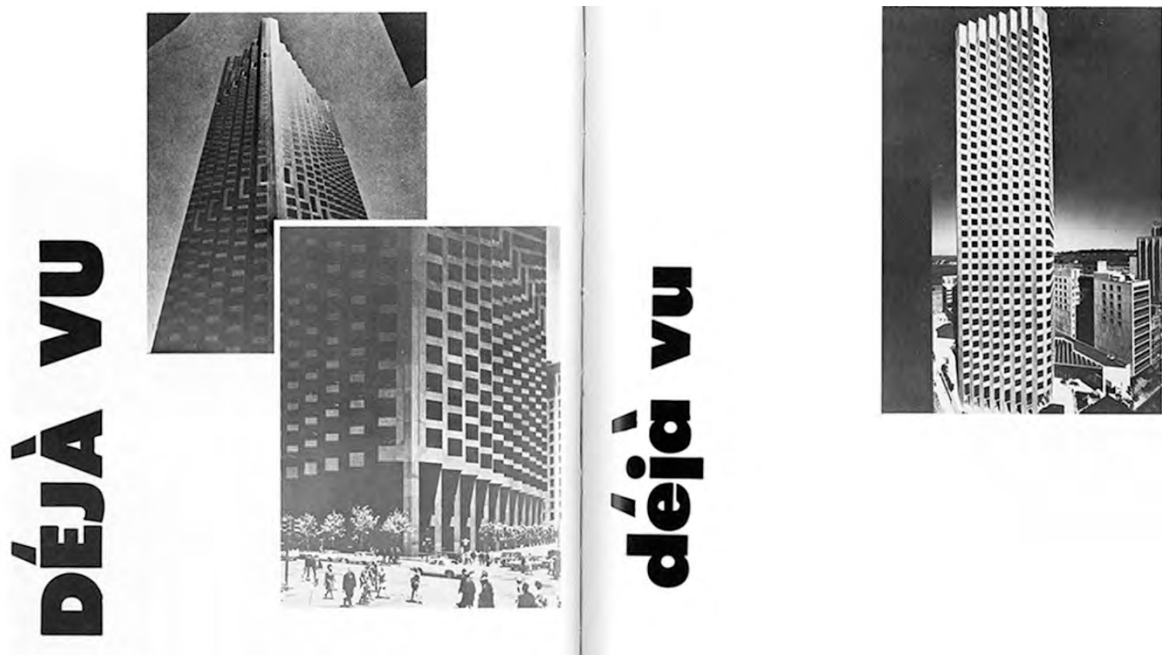


Figure 7.4

“Dé-jà vu”: a visual comparison between the Bank of America, San Francisco and Allendale Square, Perth proposed by Architect W.A., 1977

Occasional contacts and travels of Australian architects with the United States continued during the 1970s and 1980s. The directors of Godfrey Spowers in Melbourne, for example, were invited by their clients to take trips to America to observe in person some American tall buildings in view of the design of Capital House and Bourke Place.²²

The 1980s saw a *coda* of direct participation of American architects in the design of Melbourne's skyscrapers. Johnson and Burgee were engaged to design the lobby of 101

²⁰ Allendale Square was recipient of the 1977 Alcoa Award for Architecture and of the Australian Energy Conservation in Building Award. “Alcoa 77,” *Architecture Australia* 66, no. 3 (June-July 1977): 72-77; “Energy Conservation Building Award,” *Builder NSW* 8, no. 1 (February 1979): 22-25.

²¹ “The World Trade Center Curtain Wall Details Stress Latest Ideas,” *Architectural Record* 142, no. 2 (August 1967): 213-216.

²² John Davidson, interview, 28 November 2014.

Collins Street, after the initial concept designed by the local architect was discarded by the client.²³ The American firm of Sheperd Nelsen and Wheeler, in collaboration with local architects Peck von Hartel Trethowan, designed the historicist building of 333 Collins Street with a style aimed to satisfy “the client's desire to emulate the classic skyscrapers of New York”.²⁴ In the mid-1990s, in Southbank, the two towers of the Southgate complex were designed by the San Francisco firm of Sprankle, Lynd and Sprague in collaboration with local architects Buchan Laird and Bawden.²⁵

In summary, the most enduring legacy left by American architects in Melbourne is a handful of tall office buildings towers designed from late 1950s to the early 1990s. The most prominent of these buildings took similar shapes in typology but stemmed from different minds such as Chuck Bassett, Bruce Graham, Fazlur Khan and the duo of I.M. Pei and Henry Cobb. Considering the legacy and place in history held by AMP Square, BHP House and Collins Place for the development of skyscrapers in Melbourne, it is evident that irrelevant of contingent influences arising from different individuals, firms and projects, the typology of centre core square plan towers continued as the leitmotif of office towers in the Australian city.

Before drawing conclusions upon the multiples causes of the fortune of this model in Melbourne, it remains to assess if this typology that was congenial for Melbourne was linked to an American praxis of tall office building design. This chapter presents an outline that may be subject to further verification, and it should be read as a broad sketch needy of corroboration with further city-based studies contextualised in North America. Keeping this limitation in mind, the argument proposed here is that the pattern of techno-economic evolution observed in Melbourne was matched by a nationwide trajectory of development in the United States of America, where design trends influenced by economic and technological inputs prompted to the definition of a new building type: the monolithic square or ‘squarish’ skyscraper. This trajectory is sketched through evidence from articles in American periodicals of architecture, namely *Architectural Record*, *Architectural Forum* and *Progressive Architecture*. A process of genesis, evolution and decline of this international tall building model - and of the building technologies associated to its origin -

²³ “101 Collins Street,” *Architect* (August 1991): 13.

²⁴ “333 Collins Street,” *Architect* (August 1991): 8.

²⁵ Peter Georgiev, “The Speculative City,” *Architect* (April 1991): 12

emerges, suggesting the existence of strong parallels with Australia, and reinforcing the international – rather than local - character of the empirical evidence given so far for the city of Melbourne.

7.1 The Sheridan-Karkow formula

The American genesis of modern office space quality

Early feasibility criteria in America

There are several architects who wrote about the genesis of commercial space design and of the stringent economic implications affecting the architecture of American skyscrapers. In New York, for example, written evidence was left by Cass Gilbert, George Hill and R. H. Shreve. Gilbert is notorious for defining the skyscraper as a “machine that makes the land pay”,²⁶ and Hill discussed the topic of economy in tall office buildings in a long article on *Architectural Record* in 1904.²⁷ Shreve wrote a landmark article in the same journal in 1930, where the implications of the zoning laws on the typical floor plans of the pyramidal towers of Manhattan were expounded in detail.²⁸

Other considerations for the architectural design of tall office buildings were discussed in Chicago, not only from an architectural standpoint but also from that of developers. The imperative to conceive a fitting architectural quality in tall office buildings was discussed first of all by John Wellborn Root in 1890, who relied on “experience” in order to determine a plan where “every foot within it shall be perfectly lighted, and all spaces which would be dark thrown out”. The parameter to control daylight was, for Root, “depth” – or the average distance in the plan from the wall line where daylight could reach the interior during the year. Based on the intake of light from floor-high windows, Root’s experience dictated that, in Chicago, office building depth should not exceed 24 feet.²⁹

²⁶ Cass Gilbert, “The Financial Importance of Rapid Building,” *Engineering Record* 41 (30 June 1900): 624, quoted in Shannon Irish, “A ‘Machine that Makes the Land Pay’: the West Street Building in New York,” *Technology and Culture* 30, no. 2 (April 1989): 378.

²⁷ George Hill, “The Economy of the Office Building,” *Architectural Record* 15, no. 4 (April 1904): 313-327.

²⁸ RH [Richmond Harold] Shreve, “The Economic Design of Office Buildings,” *Architectural Record* 67, no. 4 (April 1930): 340-359.

²⁹ John Wellborn Root, “A Great Architectural Problem,” *Inland Architect and News Record* 15 (June 1890): 66-71.

Space quality and risk

The developer's point of view on such matters was documented thoroughly by Leo Sheridan, a Chicago-based real estate executive,³⁰ who wrote a lengthy article in *Architectural Forum* in 1924.³¹ Sheridan outlined six factors of importance for rentability: (1) "convenience of location", (2) "imposing structure", (3) flexibility with "well lighted layout", (4) "atmosphere and environment", (5) "efficient and pleasing service" and (6) "attractive rental rates".³² The Chicago developer remarked that entrepreneurs of large office buildings had to carry a high level of risk. The entity of borrowing required, the long period between conception and completion, volatile building technologies, and the difficulty in ascertaining the demand of office space in a city, were factors that made the financial outcome of any tall building development highly uncertain. The nature of this economic challenge was such that "economic consideration [should] receive at least as much attention as [...] architectural design and engineering standards".³³

Economic considerations thus had to translate into strategies to minimise risk. The first step to be undertaken, Sheridan suggested, was an economic investigation to ascertain the demand of office space in the region of the development. A set of simple rules and numeric indicators were available to inform decisions. One, for example, was to calculate and compare the average office floor space per capita in a city against the one of other cities. To offset risk, an American tall office building of the 1920s should not be conceived as a mono-functional development. Ground floor space for retail leasing was of equal economic importance as the upper floors. Sheridan explained with a simple rule of thumb the expected level of return:

The most successful office building today is not a structure which is used wholly and solely for offices. It is one which draws the maximum possible income from its ground floors by leasing them for retail purposes. In fact, a general rule used by many experts in obtaining a site is that in order to be a financial success a tall building upon the proposed site should be

³⁰ In 1924 Leo J. Sheridan was an employee of the real estate financing company S.W. Straus & Co. Sheridan would later establish his own real estate management firm in 1929 and serve as president of the National Association of Building Owners and Managers (NABOM) and as president of the regional branch of NABOM in Chicago. M. Moore, *Moore's Who is Who in Wisconsin* (Los Angeles: McKinley Hodge, 1960), 877, s.v. "Sheridan, Leo J."

³¹ Leo J. Sheridan, "Economic Factors of the Office Building Project," *Architectural Forum* 41, no. 3 (September 1924): 121-132.

³² Sheridan, 121.

³³ Sheridan, 121.

able to earn from the leasing of its ground floors and basement space sufficient to pay taxes and a reasonable return upon the cost of the land.³⁴

Efficiency, shape and height

Sheridan gave detailed explanations on a range of spatial design issues, including aspects of building modularity, floor plan shape and layout. Real estate specialists played an important role in the design of tall buildings as specialist advisors to architects on matters of spatial efficiency:

For years S.W. Straus has maintained a plan service department, manned by architects, engineers and practical loan experts, whose duty it has been to revise building plans submitted to them with the aim of reducing cost of construction, eliminating waste space, adapting layout to serve most effectively the needs of prospective tenants, and in these and other ways increasing the rate upon the investment.³⁵

Sheridan shared some of his own expert knowledge indicating the importance of keeping a ratio of efficiency for rentable area, which set expectations that were - not far from later standards - as “70 to 80 per cent of gross building area”.³⁶ But, spatial efficiency was not limited to the quantity of usable space and it was related to quality, shape and size of the floor plan and of the site:

If the area is too small or the frontage too narrow, it is impossible to improve it intensively enough to secure for the owner a return not only upon his building but also upon the land for which he has probably paid a king’s ransom. The “vertical toothpick,” like the inside lot building, has rarely proved a success.³⁷

In these cases, key for the economic assessment would be “the disproportionate amount of enclosing wall”³⁸. Sheridan thus explained a key concept, the wall to floor ratio, a device of cost control that demonstrated the advantage of square sites and building plans against land parcels and plans too irregular – and too elongated - in shape:

(...) a moment’s calculation will show that a building 100 by 100 would bring a saving over a structure 70 by 143 of nearly 15 per cent in the cost of constructing the exterior walls alone. Further, as the floor area is increased, the percentage of unproductive area (i.e. for elevators, stairways and other service facilities) decreases, and the operating cost per square

³⁴ Sheridan, 121.

³⁵ Sheridan, 128.

³⁶ Sheridan, 123.

³⁷ Sheridan, 123.

³⁸ Sheridan, 123.

foot declines. Generally speaking, the larger the lot and the more nearly it approaches a square in shape, the lower the unit cost and the greater the efficiency of rentable space.³⁹

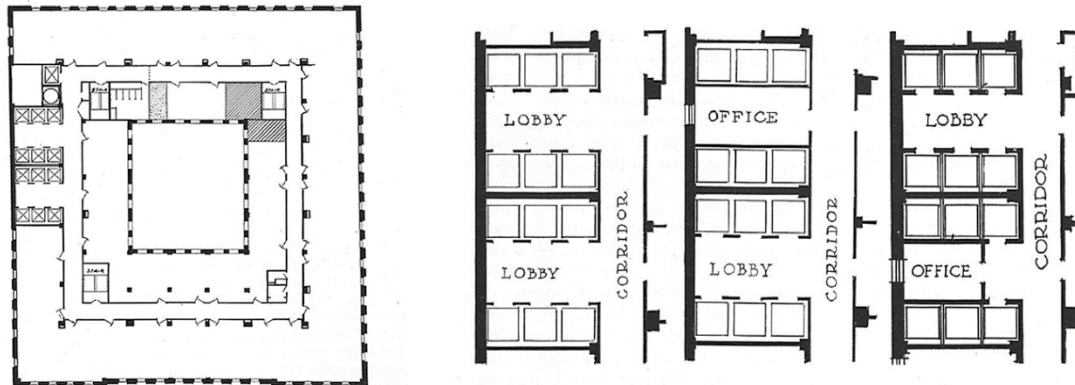


Figure 7.5

Straus Building, Chicago; plan and detail of arrangement of lift banks in multiple groups, 1924

The question of the economic limitation of the height was also discussed,⁴⁰ observing that beyond a certain height, as construction costs increased, returns were bound to diminish. While most buildings of the time considered a height of 24 storeys to be the maximum economic target, Sheridan mentioned that with growing land costs and larger lots available, a taller economic height could be achieved in the future.⁴¹

The problem of economic height was then interwoven with space requirement for lifts. Sheridan provided a rule of thumb, which indicated a ratio of “one elevator for every 20,000 to 30,000 square feet of floor area”.⁴² The exact number of cars, however, had to be determined after a detailed analysis that considered the probable population of the building, the destination of use and the peak load. The critical target of performance of the lift system was a “satisfactory time interval” of 25 to 30 seconds at rush hour. Sheridan showed clever space-saving measures that took advantage of lift drop offs. These measures included the use of express elevators and lift groups arranged in batteries with lift lobbies

³⁹ Sheridan, 123.

⁴⁰ Sheridan, 124.

⁴¹ Sheridan, 124.

⁴² Sheridan, 123.

occupied by usable office space on the floors where lifts would drop off or travel through without opening doors.⁴³

The Sheridan-Karkow formula

Years later, while serving as the president of National Association of Building Owners and Managers (NABOM), Sheridan established with engineer Waldemar Karkow a scientific method for pricing office building rents in America. The method was a quality assessment developed to establish fair and equitable schedules during the highly competitive years of the Depression. Details were presented by Sheridan at a convention of NABOM in Pittsburgh in 1933 and the method, known as the Sheridan-Karkow formula, became the most relevant one for office rent valuation in USA until and beyond WWII.⁴⁴

The Sheridan-Karkow formula worked out rent variations from the base rate of a “typical” office bay of 18 feet by 25 feet located at the eighth floor of a building’s main frontage.⁴⁵ The typical price was then adjusted by multipliers linked to variations from the space quality of this typical bay. Variations that triggered growth in value were higher floors, corner locations and exposure to daylight and views. Conversely, lower floors and less access to daylight and views, such as excessive depth from the envelope, triggered reductions in value.

So, for example, if the typical bay at the eighth floor had a base rate of \$5 per square foot, a bay at the eighteenth floor, considering a multiplier of 1% for each floor above the eighth, would be priced for \$5.50 per square foot. If the space at the upper floor was less deep than 25 feet, the rate would increase further with an additional 1% for each foot of depth less than 25 feet. A bay at the eighteenth floor with two windows (18 feet wide) and 15 feet depth would have a price of \$6 per square foot – e.g. 20% more than the typical bay of the eighth floor. In this way, the formula established an official real estate premium that offset costs associated with taller construction.

⁴³ Sheridan, 128.

⁴⁴ Earle Schultz and Walter Simmons, *Offices in the Sky* (New York – Indianapolis: Bobbs-Merrill, 1959), 206-207.

⁴⁵ James C. Downs, *Principles of Real Estate Management* (Chicago: Institute of Real Estate Management 1957), 238.

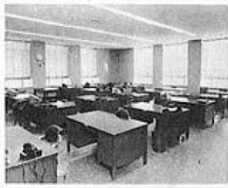
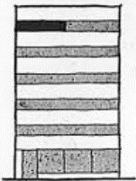
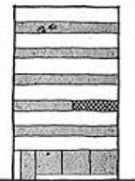
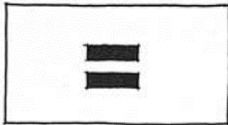
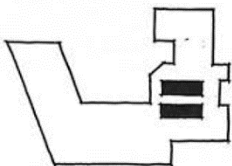
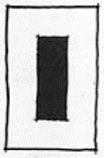
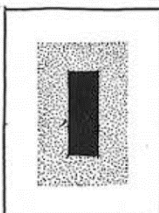
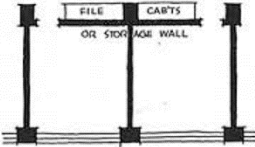
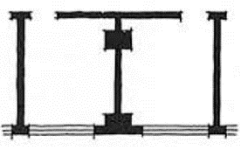
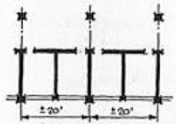
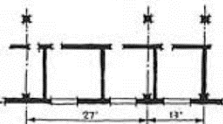
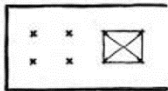
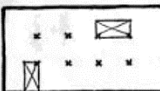
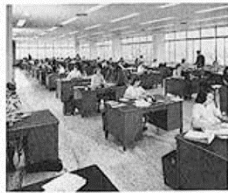
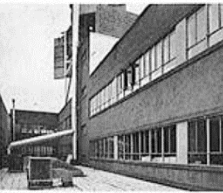
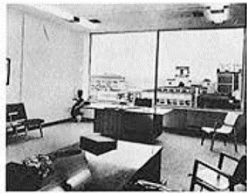
FACTORS WHICH AFFECT REAL ESTATE VALUE			
MORE DESIRABLE	LESS DESIRABLE	MORE DESIRABLE	LESS DESIRABLE
			
CORNER OFFICE	ONE-WALL	SUN CONTROL	GLARE
			
UPPER FLOOR	LOWER	REGULAR SPACE	IRREGULAR
			
SHALLOW SPACE	DEEP	GOOD COL. LOCATION	AWKWARD
			
STANDARD SPAN	NON-STANDARD	FREE SPACE	CROWDED
			
CLEAR VIEW OUT	ROOF OR OBSTRUCTED VIEW	BIG WINDOWS	SMALL

Figure 7.6

Design guidelines proposed by *Architectural Record* to meet space quality expectations set by the Sheridan-Karkow formula, 1953

The Sheridan-Karkow formula survived World War II with updates necessitated by air conditioning and fluorescent lighting,⁴⁶ and in 1950 the architectural implications of the

⁴⁶ Downs, 208.

formula were summarised in *Architectural Record*.⁴⁷ Space quality was seen to affect positively building value and employee's productivity. Desirable qualities were: corner offices, upper floors, shallow space depths, standard spans, clear views, sun control, regular (rectilinear) footprints, modular coordination between columns and partitions, free (open) space and large windows. Negative design factors were: narrow office bays, lower floors, deep space, non-standard spans, roof or obstructed views, sun glare, irregular footprints, awkward column-partition arrangements, crowded spaces and small windows.

After World War II, this vocabulary of architectural quality in office buildings merged with radical technological progress made in the field of steel and concrete structures, façade technology and building services, and among the latter, in particular, progress was made in lift, lighting and air conditioning systems. It was at the convergence of these techno-spatial innovations that a new high-rise building typology grew in America and, from there, it influenced significantly the development of high rise design and technology internationally.

7.2 The conquest of deep space

Building services and the rise of the international skyscraper

The 'servolift'

In the early 1950s, after half-century of research and development, the idea of the "operator-less elevator" or "servolift" became a reality suitable for large multi-storey buildings. The principal incentive for the introduction of lifts operated directly by passengers was of economic nature. The cost of salaries of lift assistants was in fact one of the largest operating expenses that faced the owners of office buildings of the times.⁴⁸

Passenger-controlled lifts had existed as an idea since the 1890s, but found application only in smaller buildings and hoists.⁴⁹ The real important point of difference of post-war 'servolifts' was the incorporation of intelligent electronics and centralised control. New systems of automatic control could coordinate different cars by avoiding redundancies, as it may have occurred, for example, if two lift operators would answer the same call.

⁴⁷ Frank Lopez [ed], *Commercial Buildings: an Architectural Record Book* (New York: Dodge, 1953), 174.

⁴⁸ "Operatorless Elevators," *Architectural Forum* 98, no. 1 (January 1953): 154-156.

⁴⁹ G.B. Gusrae. "Elevators Are Getting Smarter," *Architectural Record* 115, no. 4 (April 1954): 210-215.

Electronics could vary car movement in response to traffic demand with sophisticated and ‘smart’ systems of control that kept memory of complex commands. Inputs given directly by the passengers were elaborated automatically, and met more efficiently traffic demand at peak times.⁵⁰

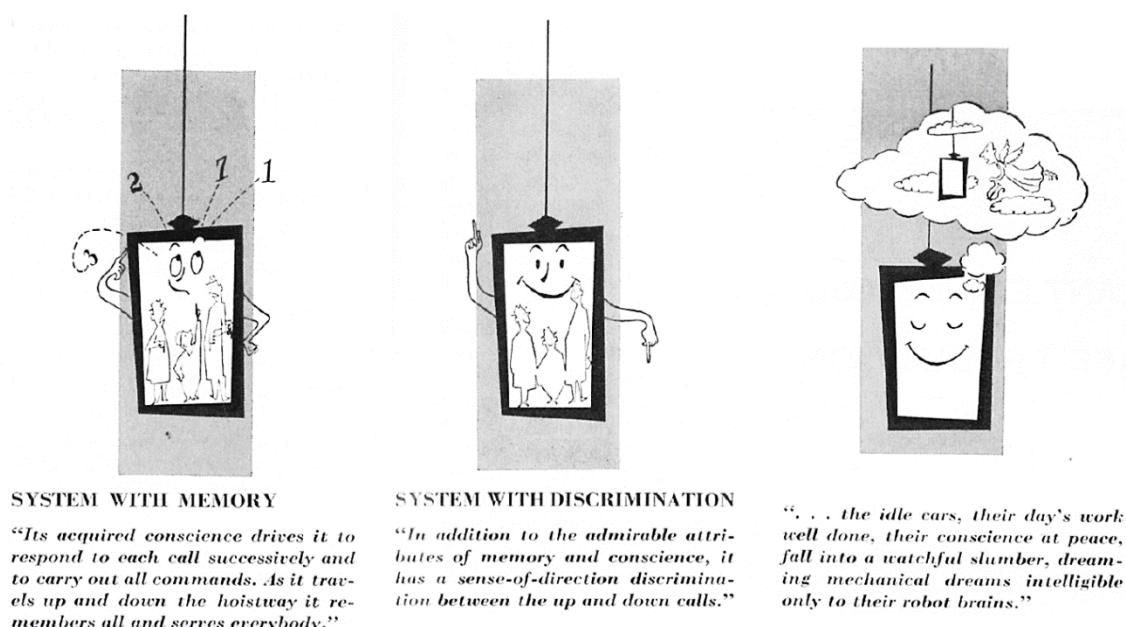


Figure 7.7

Innovation features of “servolifts”, “operatorless” or “smart” lifts illustrated by *Architectural Record*, 1954

Advancements in electronics merged with progress in mechanical engineering. Auto-weighting devices were introduced in the same years, which gave the ability to close doors automatically once lift cars were almost full. New systems were developed for the safe arrest of obstructed doors, including photo-sensors installed on the leading edge of the doors and radar-similar devices that created an electrostatic field that once interrupted would cause the door to re-bounce open.⁵¹ The introduction of electronic controls helped to pre-determine the capacity of the vertical circulation system in office buildings with greater accuracy and efficiency. Operator-less lifts created new rules of design, leading to reduced numbers of lift requirements and to more predictable patterns of traffic.

⁵⁰ Gusrae, 211-213.

⁵¹ “Operatorless Elevators,” 154-155.

Changes in American office space design in the immediate post-war period depended also largely on other technological advancements in building services: the development of high-velocity air conditioning and the introduction of fluorescent tube light fittings. The combination of passenger-operated lifts, high-velocity air conditioning and permanent supplementary artificial lighting (PSALI) was in fact a milestone for the development of American tall buildings, and more generally of modern commercial architecture after World War II.⁵²

The activation of deep space

During the 1930s, the successful application of artificial climate control in office buildings was in great part compromised by the heat-output of incandescent lighting. This limitation precluded the rentability of office space beyond what could be conveniently reached by natural lighting and ventilation. The limited heat output of cool fluorescent tubes thus allowed reducing the internal cooling loads in summer to a level that was otherwise impossible to control with incandescent light bulbs.

In America, during and soon after the years of WWII, the earliest applications of fluorescent lighting were used in industrial buildings. The arrangement of fittings consisted generally of task lighting strips over workbenches, where light levels could reach up to 100 foot-candles. Other early applications were for ‘shadow-free’ drafting rooms. There, long strips of tubes were set at forty-five degrees to the room layout to illuminate evenly and minimise contrast. In other early applications, fluorescent lighting anticipated some radical changes that were bound to affect white collar workspace. Built-in fluorescent fittings in the ceiling were found suitable for window-less typing pools. In 1946, *Architectural Record* described these new kinds of spaces, which were also fully air conditioned, as a “vast improvement over most work conditions”.⁵³ Levels of 50 foot-candles of cool illumination could be reached, while additionally the ceiling “clutter” of older suspended incandescent lights was eliminated.⁵⁴

⁵² Reyner Banham, *The Architecture of the Well-Tempered Environment* (Chicago: University of Chicago Press 1969), 181-182.

⁵³ Matthew Luckiesh, “Designing with Fluorescent Lighting,” *Architectural Record* 99, no. 1 (January 1946): 65.

⁵⁴ Luckiesh, 65.

With these advancements, lighting designers and architects established new criteria of scientific assessment for the quality of illumination. As initial problems of glare with PSALI became apparent, the importance to vary the intensity of illumination according to the nature of the tasks to be performed emerged. Early problems associated with fluorescent tubes, such as long warming-up times, were overcome with the development of rapid start lamps and starter-less lamps,⁵⁵ and progress on fluorescent lighting technology continued further until the early 1970s, when new systems sought directional control of illumination with the scope of eliminating “veiling reflections”.⁵⁶ Early troubles then shifted the interest of designers from intensity to quality criteria and prompted to the recessing, shielding, and diffusing of light and the avoidance of shiny materials in interior design.

Air conditioning for comfort

In its early days, air conditioning for American buildings was defined as a matter of ‘comfort’, to distinguish the performance requirements of this type of services from those of antecedent application in industrial buildings. The design principles of artificially controlled comfort were established in America from the 1930s. An overview of the early systems of the period, which included considerations about construction and operation costs, was given in a milestone article written in *Architectural Record* by two employees of Carrier, Realto Cherne and Chester Nelson.⁵⁷ Another important article for the history of modern air conditioning followed in the same journal with detailed studies on the implications of air conditioning for interior design. In this second paper, specific reference was made on methods of air supply and return for office buildings.⁵⁸

Office design for air conditioning and PSALI had to align with the targets of quality space in office buildings set by the Sheridan-Karkow formula. The paybacks of the new type of workspace were justified in economic terms of productivity. In 1947, from the pages of *Architectural Record*, the American architect Lathrop Douglass explained:

⁵⁵ Felix B. Graham. “Basic Elements in the Planning of Electrical Systems,” *Architectural Record* 115, no. 2 (February 1954): 206-209.

⁵⁶ ““Good Footcandles’ for Better Quality Lighting,” *Architectural Record* 149, no. 1 (January 1971): 129-132.

⁵⁷ Realto E. Cherne and Chester E. Nelson, “Preliminary Planning for Air Conditioning in the Design of Modern Buildings,” *Architectural Record* 75, no. 6 (June 1934): 538-548.

⁵⁸ A. Warren Canney, “Effect of Air Conditioning on Building Design,” *Architectural Record* 38, no. 2 (February 1938): 71-81.

(...) an office building is a means of providing, on a proper site, the most comfortable, efficient, flexible space for housing the activities of employees; whether for one firm or for many. The important and very interesting question is: to what extent do these features affect the employee? Does a man turn out more work in a cool, dehumidified building, a well-lighted building with a private, sound proofed office for himself? How much more work does he turn out in these surroundings than in a humid, hot, ill-lighted bull pen amidst the clatter of typewriters and the time wasting gabble of his fellow employees?⁵⁹

Air conditioning had to be then reconciled with the cost of construction, or first cost, and operative cost, which included the salaries of the employees. The first type of cost related to the “space” or structure, the cost of “plush” (the advertising cost introduced by expensive materials and height) and the cost of the fit out, such as partitions, ceilings and services.⁶⁰ Operative costs like salaries were, according to Douglass, often overlooked by developers, who failed to understand the consequences of inefficient productivity due to poor environmental conditions indoors. Quoting evidence from direct experience, Douglass claimed that work inefficiencies due to poor workspace quality could cause a potential loss for the owner in the order of 10%, 20% or even to 50% of the salary of one employee. By contrast, the cost of air-conditioning accounted only for a small fraction of the salaries:

The annual payroll in any average office is so very much greater than the annual charges for modern improvements that it seems almost an axiom that improving the employee's efficiency is what counts – the cost of space and improvements is negligible.⁶¹

High velocity air conditioning

In the early 1950s, it was claimed that air conditioning installation increased office productivity, but high concerns regarding costs remained among developers. In 1953, in New York, the cost of air conditioning was estimated to account for 20 per cent of the average construction cost of an office building.⁶² First costs had ramifications that imposed considerable space requirements to house equipment at a loss of rental space. Talking to the audience of the Real Estate Board of New York, a partner of the engineering firm Jaros, Baum and Bolles, emphasised the nexus between the economic feasibility of modern

⁵⁹ Lathrop Douglass, “Perhaps the Best is Actually the Cheapest,” *Architectural Record* 102, n. 10 (October 1947): 122-123.

⁶⁰ Douglass, 122.

⁶¹ Douglass, 123.

⁶² Alfred L. Jaros, “The Impact of Mechanical Equipment on Design,” *Architectural Record* 115, no. 4 (April 1953): 195-203, 206.

office buildings and the all-round needs of efficient design for buildings equipped with air conditioning:

(...) air conditioning is very costly to install and to operate, and demands a relatively great amount of valuable building space for apparatus, ducts and pipes. If it is to be used, then, it is wise to design buildings so as to secure satisfactory results from the minimum quantity of air conditioning and refrigeration. (...) Air conditioning's high cost of both installation and operation has put new emphasis on the importance of reducing heat gain in summer. The offenders are sunshine, heat conduction and air infiltration (...) Obviously, small windows reduce solar heat gain. At the other extreme, the 'all-window' building required some special kind of protection if it is not to be extravagant in terms of comfort air conditioning.⁶³

Despite the perceived "extravagance" of 'all-glass' buildings, the introduction of high-velocity air conditioning systems helped to make largely glazed office buildings a commonplace in American cities. Important changes were implemented in environmental building services and some of these advancements were summarised in architectural periodicals, where the benefits of high-velocity distribution were disseminated in the 1950s.⁶⁴ An important novelty for building services of the 1950s was the introduction of automatic controls, which allowed regulating internal climatic conditions remotely whilst setting safe limits of operation to prevent failures. High-velocity and centralisation thus paved the way for the zoning of large office spaces controlled by plant room floors or attics, which found fitting application in tall buildings exposed to extreme cooling loads. These technological advancements in air conditioning had fundamental repercussions for the design of skyscrapers in America.

High-velocity air conditioning could feed air through ducts at higher speeds, which were in the order of three to four times those of earlier low-velocity systems. The most immediate advantage was less need for duct space. For a given air flow, a high-velocity duct could be reduced in size by half. But high-velocity also had a downside. Due to increased friction inside ducts, greater fan horsepower and energy consumption were required.

Additional running costs made these systems not ideal for small buildings, but paybacks became tangible in large tall office buildings, where the trend to design larger windows, and the subsequent need for higher cooling loads, made high-velocity distribution the most

⁶³ Jaros, 203, 206.

⁶⁴ "High-velocity Air Conditioning," *Architectural Forum* 102, no. 4 (April 1955): 163-165. See also C. Milton Wilson, "High-velocity Air Conditioning: Its Effect on Building Design," *Architectural Record* 119, no. 5 (May 1956): 227-231.

viable solution. Used in combination with centralised plant rooms, high-velocity air conditioning saved floor space with smaller shafts and reduced floor to floor height. This had knock-on savings on other trades and the benefits were amplified by the economy of scale typical of multi-storey construction. Due to the imperative for having ducts treated acoustically, high-velocity systems also had a quieter operation and they offered a more versatile control for deeper office plans, where diversified cooling was needed.

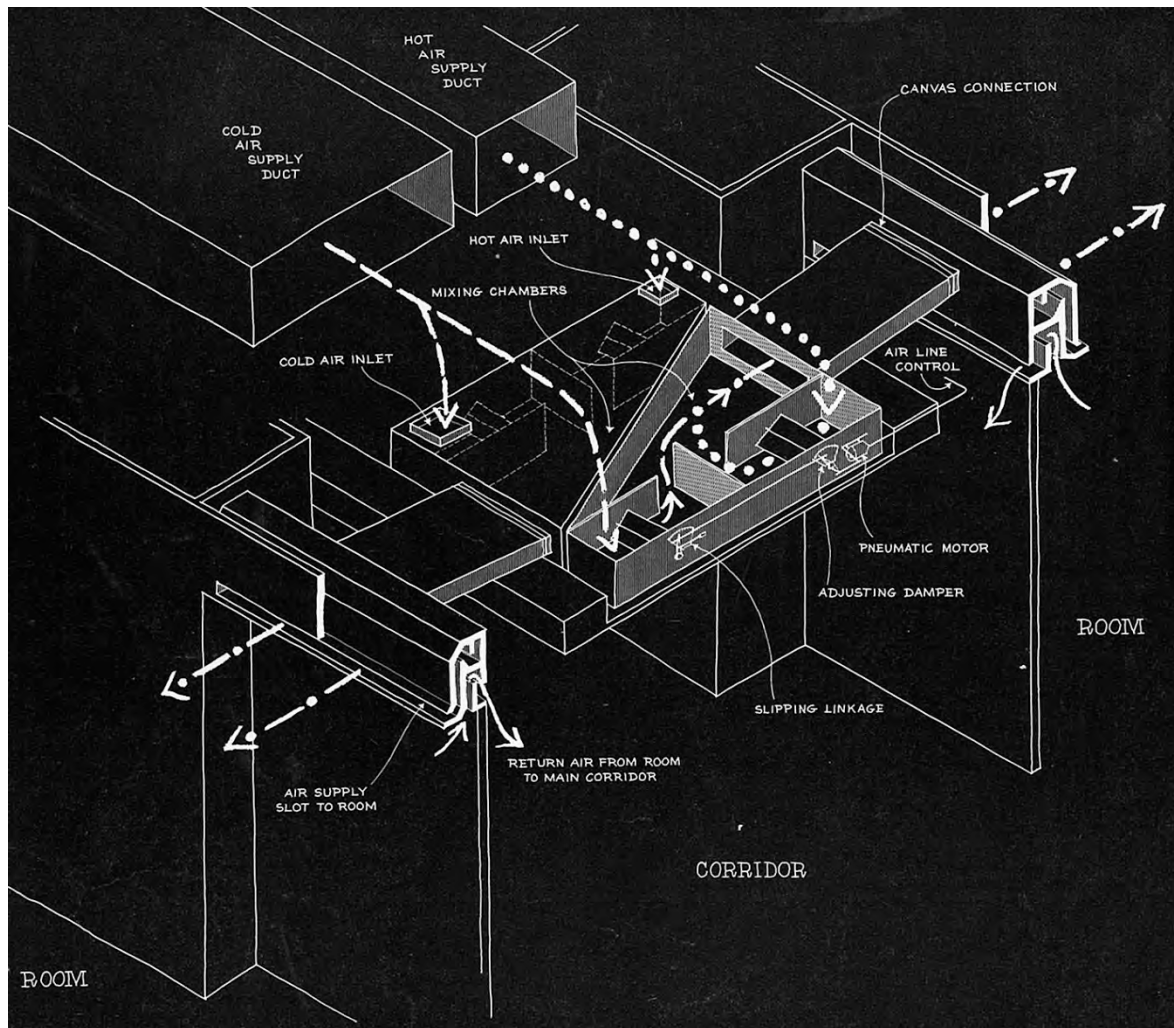


Figure 7.8

Diagram of high velocity dual duct air conditioning system illustrated in *Architectural Forum*, 1955

Deep space and man-made climate

PSALI and high-velocity air conditioning thus opened the possibility of designing workspaces at a deeper distance from the building envelope, but also created new unforeseen challenges. Deeper office buildings had to deal with two zones with

significantly different heat loads. The perimeter zone, daylight-exposed in proximity of the envelope, was subject to sweeping temperature fluctuations, and the internal zone, with more thermally stable PSALI conditions, could be controlled more reliably and economically.⁶⁵ This differential imposed a zoning approach, which was done either by designing two different air conditioning systems or by developing systems capable of varying climatic control widely within the same floor.

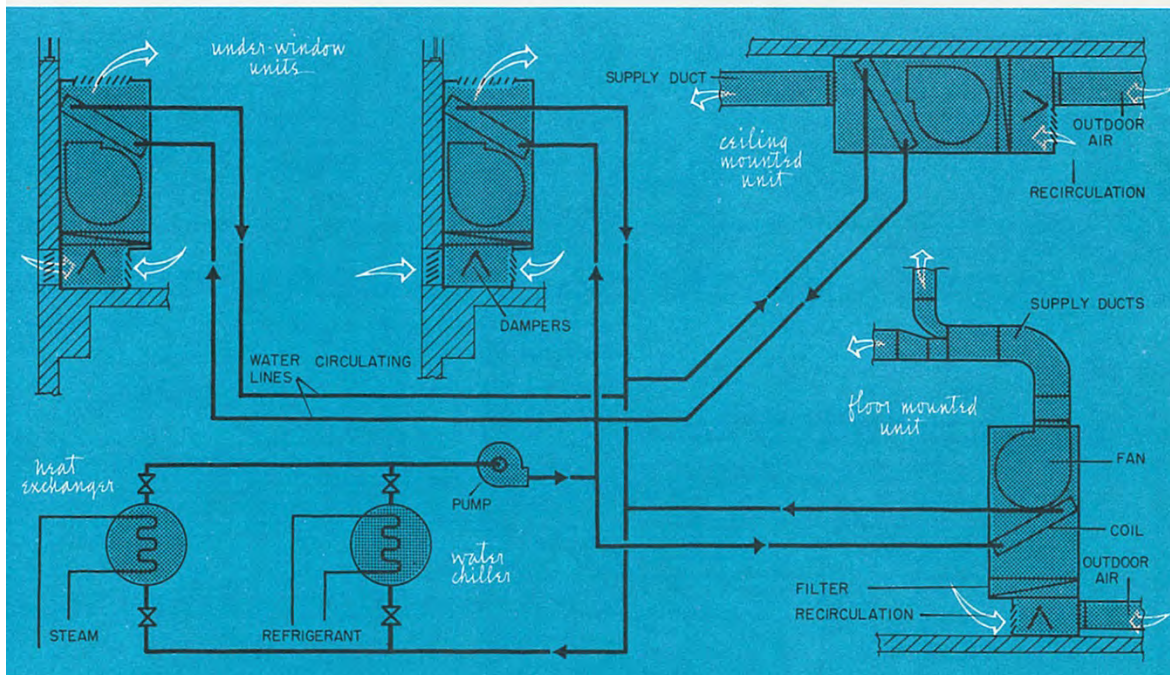
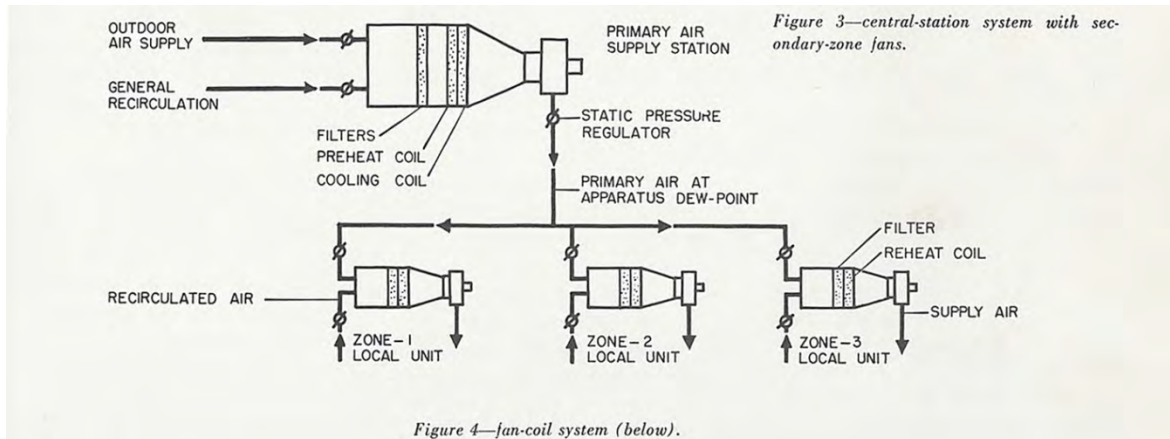


Figure 7.9

Schematics of centralised system with secondary zoning and fan coil system with under window induction systems illustrated in *Progressive Architecture*, 1958

⁶⁵ "Man-made Climate," *Progressive Architecture* 39, no. 3 (March 1958): 111-114. See also in the same volume and number E.J. Benesch, "The Outlook on Air Conditioning": 115-117 and John K.M. Pryke, "Air Conditioning: Principles, Systems and Applications": 162-177.

By the end of the 1950s, American manufacturers of air conditioning had developed an extensive range of systems, which mechanical engineers could select according to different project situations.⁶⁶ A common approach, ideal for high-differential zoning requirements, combined dual-duct distribution with perimeter under-window induction terminals. The two systems relied on progress made with high-velocity air distribution. Dual duct systems fed air supply to mixing boxes that could be ceiling mounted or used as an under-window terminal. Dual ducts offered the advantage of flexibility for individual control, but had the downside of requiring double the amount of duct space.

The perimeter induction system developed as a hybrid, fusing the benefits of fully centralised plant and local air conditioning. A series of terminals at the perimeter of the building was connected to a central air conditioning plant. Using the principle of an air flow injector, perimeter units fed high-velocity conditioned air and created an air curtain between the windows and the interior space. High pressure air supply would induce air from the room back inside the unit, normally from a return air grille located at the bottom of the terminal. Local temperature setting and filtering would occur inside the unit allowing individual control to meet the temperature fluctuations of the perimeter zone. Induction units, however, had the disadvantage of taking valuable floor space at the perimeter of the building.⁶⁷

The combination of dual-duct and perimeter induction was popular in large and tall office buildings in the USA well through the 1960s,⁶⁸ but from the 1960s, mechanical engineering interests shifted towards ceiling ventilation strategies seeking to eliminate the loss of space caused by under-window units.⁶⁹ These efforts converged in the development of ceiling distributed variable air volume (VAV) systems,⁷⁰ which being more economical to run, gained a larger market share starting from the early 1970s.

VAV systems were exemplified, among the first, by the United California Bank Building in Los Angeles (Charles Luckman, completed in 1974), where significant savings were

⁶⁶ Pryke, "Air Conditioning: Principles, Systems and Applications": 163-176.

⁶⁷ Pryke, 166.

⁶⁸ Robert E. Fischer, "Air Conditioning: a New Interpretation for Architects," *Architectural Record* 142, no. 1 (July 1967): 153-166 and no. 2 (August 1967) 125-136.

⁶⁹ "Design of Ventilating Ceilings," *Architectural Record* 133, no. 4 (April 1963): 221-223.

⁷⁰ "Three New Variable Air Volume Systems: Comfort, Economy," *Architectural Record* 149, no. 3 (March 1971): 153-154.

triggered by the diminished space requirements of this more efficient type of air conditioning.⁷¹

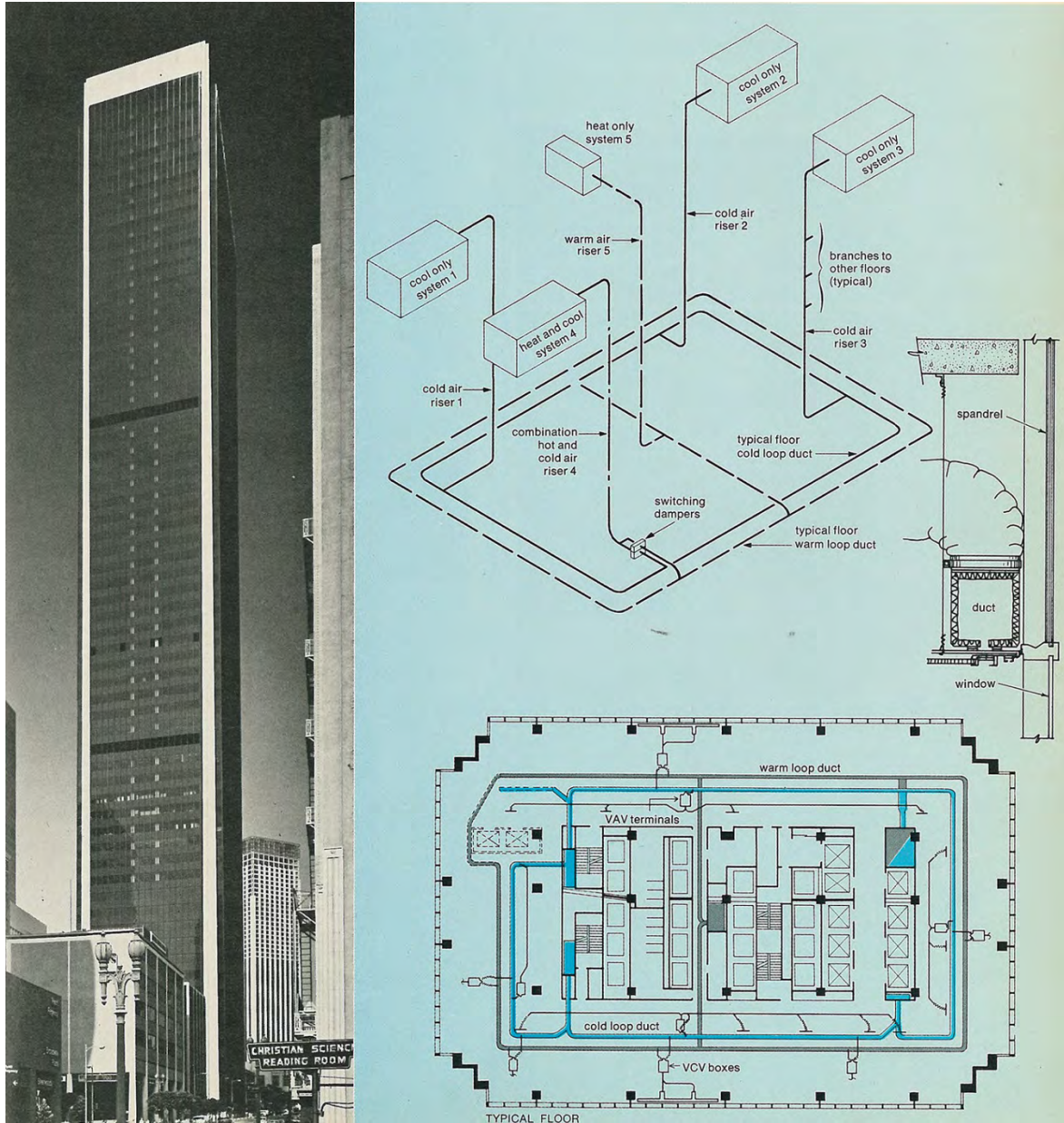


Figure 7.9
United California Bank Building, Los Angeles, California, 1972-74; external view and schematics of variable air volume air conditioning system

⁷¹ "Los Angeles Engineers 'Invent' an All-air System for a Skyscraper that Saves Shaft and Fan-room Space," *Architectural Record* 156, no. 2 (August 1974): 107.

7.3 From the crystal tower to integral architecture

Building materials and the rise of the international skyscraper

New steel technologies

The progress in building services that sparked new spatial models of tall office building design was paralleled by innovations in building materials that changed high rise construction. In the USA, after World War II, radical technological changes driven by military demand flowed into the civil construction industry,⁷² and soon after the end of the conflict, advancements in building materials were adopted by a new generation of skyscrapers. In this context of transformation, important changes originated in USA in the sector of steel fabrication where arc-welding and high-strength bolting techniques diffused and developed quickly after World War II.⁷³

Welding equipment, methods of design, quality control and regulations were significantly improved for military purposes during the conflict, and, after the war, excess capacity from military plants, combined with plenty of welders trained for ship and aircraft manufacturing, made this technology available on building sites at good market cost.⁷⁴

The diffusion of arc welding in the building industry saw a corresponding decline in riveting. In the United States, after WWI, riveters from shipyards had flooded the construction industry but, during WWII, skilled steel fabricators switched over or were trained *ex-novo* as welders, thus initiating an irreversible decline of riveting for primary structural purpose.⁷⁵ Exemplifying this shift was the improved efficiency in the fabrication of trusses, which, if welded, required less gusset plates and were faster and lighter to build. Arc-welding introduced an economic way of prefabricating components offsite and assembling larger parts on-site. This new method of partial prefabrication permitted the design of structures with semi-flexible connections and with an economical combination of shop-welded and site-fastened parts.

⁷² Joel Davidson, "Building for War, Preparing for Peace: World War II and the Military-Industrial Complex," in *World War II and the American Dream: How Wartime Building Changed a Nation*, edited by Donald Albrecht, (Cambridge, MA: MIT Press 1995), 184-229.

⁷³ Carl W. Condit, "New Departures in Steel Framing," in *American Building: Materials and Techniques from the Beginning of the Colonial Settlements to the Present* (Chicago: The University of Chicago 1982 [1968]), 192-213.

⁷⁴ "Wartime Advances in Welding," *Architectural Record* 100, no. 1 (July 1946): 111-115.

⁷⁵ "No More Riveting? Growing Scarcity of Riveters Forcing Use of Efficient High Strength Bolts," *Architectural Forum* 96, no. 3 (March 1952): 120-121, 160.

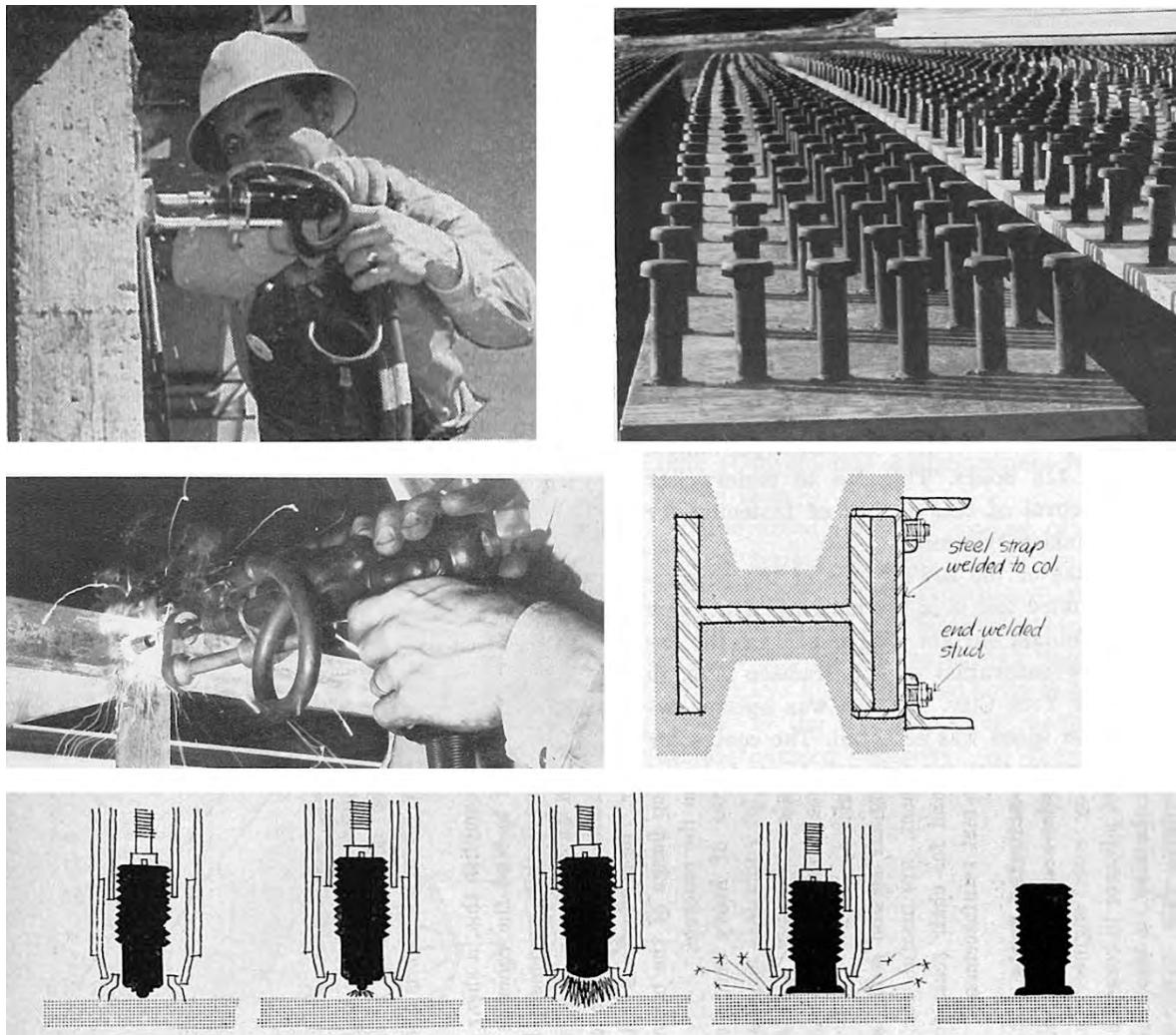


Figure 7.11

Selected illustrations of stud welding fastening method in *Architectural Forum*, 1956

The most critical advantage of welding for high-rise building was the ease of making rigid connections for multi-storey framing. Moreover, welding was a ‘silent’ technique. In 1948, *Architectural Engineering*, the technological news section of *Architectural Record*, reported the fast completion of an early example of “all-welded” multi-storey structure, where site arc-welding permitted the building of “noise-free” rigid frames where nuisance to neighbouring property was not allowed.⁷⁶

⁷⁶ “14-story Structure Erected Speedily, Quietly by Arc Welding,” *Architectural Record* 103, no. 3 (March 1948): 167. The building reviewed was the Hermann Professional Building at the Texas Medical Center in Houston.

Steel-jointing methods based on mechanical fastening, however, did not disappear and rivets were replaced by high-strength bolts. Bolted connections allowed steel trades to be more competitive because bolting required less labour. Moreover, bolting needed less specialist skills, provided faster installation time, made less noise and allowed ease of inspection; it was safer, stronger and gave opportunity to control tension with scientific precision.⁷⁷

New engineering possibilities were opened, combining bolting and welding in rigid, semi-rigid and flexible connections, giving plenty of alternatives to cover larger spans and building higher at a lower cost. A strategic advancement for these hybrid jointing methods was the invention of stud welding, a process with which threaded or bolt-ended rods (studs) could be attached with easily portable arc welding guns. Stud welding had radical repercussions for the construction of structures and building envelopes because it introduced faster and adjustable methods of connection between primary support and façade brackets. Another important repercussion of stud welding was for composite steel-concrete structures in bridge construction, where shear connecting studs could be easily welded on the top flanges of steel beams. This technique was then transferred to general floor construction in steel-concrete decking, a type of floor construction that is essential for all-steel buildings.⁷⁸

These three technological changes in steel fabrication (arc welding, high-strength bolting and stud-welding) were adopted with far-reaching consequences by the American high-rise construction industry, and innovation patterns of not less importance affected other trades of commercial construction, in the sectors of aluminium, glass and concrete.

Aluminium and glass

A compelling demonstration of aluminium's potential for architecture was the Headquarters of Alcoa in Pittsburgh, a building which *Architectural Forum* defined as "America's most daring experiment in modern office building."⁷⁹ The Alcoa Building, designed by Harrison & Abramovitz, stood apart among the much-publicised glass façades of the time, as it differed through its method of modular construction with solid metal

⁷⁷ "High-strength Bolts," *Architectural Record* 118, no. 1 (July 1955): 189-193.

⁷⁸ "New Trends in Structural Fastening," *Architectural Forum* 104, no. 4 (April 1956): 161-163.

⁷⁹ "Alcoa: Complete," *Architectural Forum* 99, no. 5 (May 1953): 124-131.

panelling. The cladding system of the Alcoa Building summarised these benefits eloquently as a form of advertising for its owner and for the global industry of aluminium. Thin floor-to-floor prefabricated panels fitted well with the ceiling-distributed air conditioning system - giving maximised floor area - that were quickly installed by workers of average skills without scaffolding or abseiling. Enclosure was done from inside-out and extended to maintenance operations; windows hinged on a central pivot and could be unlocked opened for cleaning from inside by deflating a rubber seal gasket.⁸⁰

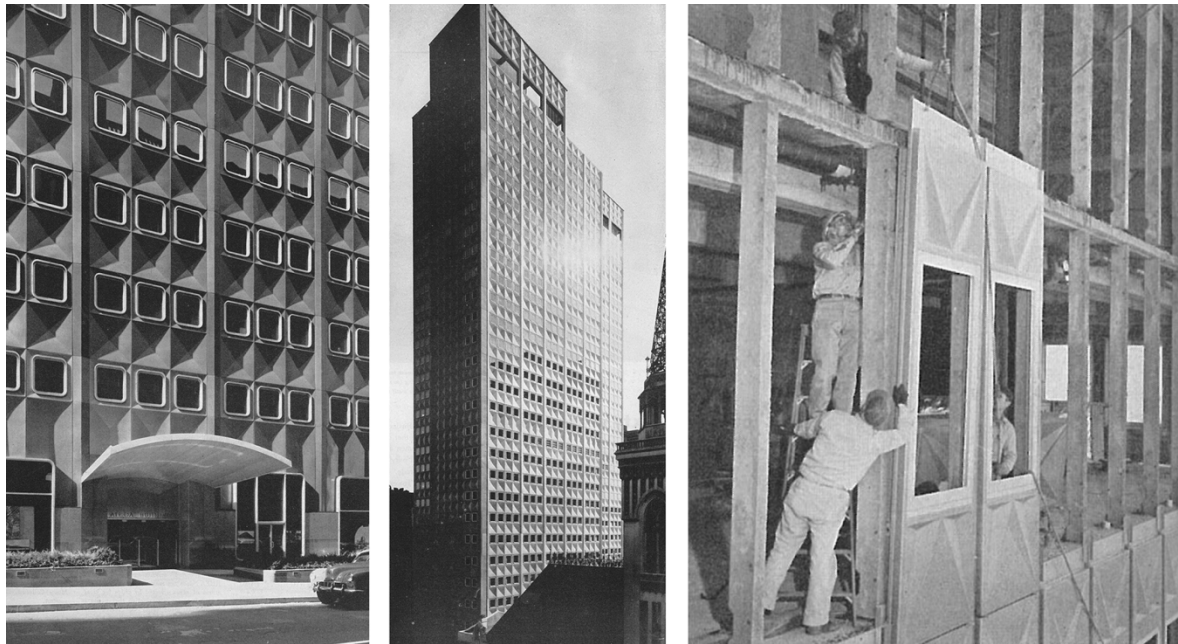


Figure 7.12

Alcoa Building, Pittsburgh, Pennsylvania, 1951-53 (left and centre) and panelised cladding system similar of Alcoa Building under construction at the Republic National Bank Building, Dallas, Texas, 1954

Aluminium had unique advantages due to safe, lightweight and fast methods of installation that relegated glass to a secondary material,⁸¹ and for the technological evolution of tall building envelopes in the twentieth century, the modular prefabrication of Alcoa set an example with a legacy not less important than the much more celebrated “crystal towers” of the time.⁸² While the Alcoa Building stood as a daring experiment in contrast to the

⁸⁰ “Alcoa: Complete,” 128.

⁸¹ “The Concept of the Thin Curtain or Filter Wall,” *Architectural Record* 103, no. 2 (February 1948): 136-139.

⁸² “Our New Crystal Towers,” *Architectural Forum* 98, no. 2 (February 1953): 142-145; A very similar envelope system to the one of the Alcoa Building was used in 1954 at the Republic National Bank in Dallas,

glass box paradigms of its time, a more enduring impact of aluminium in the American construction industry was given by the capacity of the newly introduced metal to act as the ideal complement to glass in curtain walls. In the 1950s, tall office buildings relied on standard glazing products with limited capacity to filter solar energy. In addition, architects of office buildings with large expanses of glass faced the need to reduce glare, which could be moderated only by tinted heat-absorbing glass.

In North America, glass supply for construction was severely restricted by the automotive-driven duopoly of the two major national manufacturers, Pittsburgh Plate Glass (PPG) and Libbey-Owens-Ford (LOF). Concomitantly, the availability of standard clear plate glass at good price restricted designers in search of custom colour glass, which was difficult to source even for the most prestigious projects.⁸³ The application of newly introduced building materials in large scale projects, such as aluminium and heat-absorbing glass – led to a process of innovation where progress was made through trial and error and where even landmark projects such as the United Nations Headquarters and the Level House in New York were subject to significant building failures associated with glazing.⁸⁴

In the 1950s, the quality of sealing compounds was still at an early stage as much as the methods of commercial glazing in aluminium frames, until experience gained with extruded aluminium profiles eventually drove architects to find detailing solutions such as dry and captive glazing. Glazing techniques improved thereafter with the development of new sealing compounds, such as polysulphide sealants like “Thiokol”, and from the late 1960s, with the first applications of silicone. Dry glazing with neoprene gaskets, initially very expensive, became eventually a standard of the 1960s and 1970s due to the diffusion of flexible “zipper” glazing, a technique developed originally for car windshields.⁸⁵

Texas, also designed by Harrison & Abramovitz. “Structure, Enclosure, Equipment, Economics and the Architect’s Talent,” *Architectural Record* 115, no. 4 (April 1954): 187-194.

⁸³ David Allison, “Growing Pains in Glass,” *Architectural Forum* 105, no. 6 (December 1956): 152-157.

⁸⁴ SLV, Stephenson and Turner Archives, volume 1047, R.V. Miller and L. R Crandall “Notes Regarding Difficulties Experienced with Façades on New Buildings,” 3-4.

⁸⁵ Several contributions to the insert “Architectural Engineering” of *Architectural Record* give account of progress in sealants and glazing compounds during the 1960s: Julian R. Panek, “How to Prevent Joint Sealant Failures,” *Architectural Record* 131, no. 5 (May 1962): 217-218; Matt Sitter, “How to Specify Polysulfide Sealants,” *Architectural Record* 140, no. 2 (August 1966): 153-154; Ranger Farrell, “Designing Building Exteriors with Sealants in Mind,” *Architectural Record* 141 no. 1 (January 1967): 169-174; “Sealing Joints: the Technology and the Art,” *Architectural Record* 143, no. 5 (May 1968): 203-210.

The owner-built Libbey-Owens-Ford (LOF) Building in Toledo, Ohio, designed by the New York office of Skidmore Owings Merrill, can be considered as fitting example of the state-of-the-art American high-rise façade technology of the 1950s.⁸⁶ The building was a strategic point of arrival in the evolution of glass-walled skyscrapers, for it demonstrated through the commitment of a global leader in glass manufacturing, the critical role of high-performance glazing in air conditioned office buildings. The LOF headquarters made extensive use of double glazed “Thermopane” units, which were installed without scaffolding from a platform supported from the crane of the roof maintenance unit. For the first time in a large multi-storey application, the units were dry glazed with neoprene H-shaped zippers fixed on a stick aluminium frame. An economic study prepared by the mechanical engineers demonstrated that – in comparison with a single glazed option - the additional cost required for double glazing could be recuperated in as little as three and half years by savings derived both from first and operation costs of the air conditioning system.⁸⁷

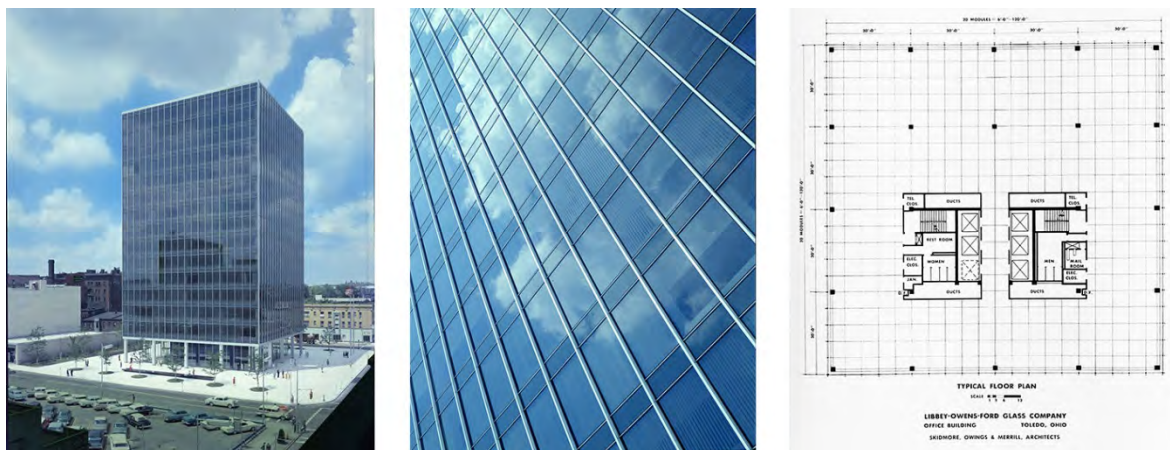


Figure 7.13

LOF Glass Company Headquarters, Toledo, Ohio, completed in 1960

Concrete and mechanisation

After World War II, reinforced concrete technology progressed with new methods of mechanised material handling and formwork. Concrete became gradually suitable for tall

⁸⁶ “Executive Office Building, Libbey-Owens-Glass Co.” *Architectural Record* 128, no. 4 (October 1960): 187-196.

⁸⁷ Ward M. Canaday Centre for Special Collections, University of Toledo, Libbey-Owens-Ford Glass Company Records, box 16, folder 17, Guy B. Panero Engineers, *Economics of a Glass-Walled Skyscraper*, Libbey-Owens-Ford Glass Company Archives, 1961.

building construction and surged as a competitor to steel for primary structural applications in the 1960s. Knowledge of concrete pre-stressing, which existed in the pre-war period,⁸⁸ developed further in the USA during the 1950s and found first application on tall buildings with standardised prefabricated beams, columns and piles.⁸⁹ Initially, prestressed concrete was used in industrial and civil engineering construction, but one early application was made in a tall office building, the Norton Building in Seattle (Skidmore Owings Merrill, completed in 1959). The brief of the building required a completely speculative project with a column-free floor plate, the “ultimate in rental desirability”⁹⁰, which was achieved with prestressed and precast I-beams spanning 70 feet and supporting a concrete slab topping.

By the mid-1960s, the use of prestressed concrete in tall buildings had expanded considerably. In 1965, T.Y. Lin, the structural engineer of the Norton Building, outlined in *Architectural Record* the advantages of prestressing in tall structures: suitability for repetition of forms, reduction of weight, possibility of achieving longer spans and better resistance to vertical loads. Lin envisaged how long-span beams could be used with building layouts where continuous perimeter framing could be eliminated, thus concentrating vertical and lateral support only on a centre core and four corner points.⁹¹

Alongside the growth of prestressing, the alternative concrete technology of post-tensioning gained interest in the concrete industry. Some first examples of post-tensioning applied to multi-storey buildings and were published by *Architectural Record* in 1967. A study on post-tensioning showed that, if used in combination with flat plate slabs, structural cost could be reduced in the order of 20 per cent.⁹²

Since the early 1950s, on-site mechanisation became more prominent in American building construction sites. The immediate benefits of mechanisation were felt for material

⁸⁸ H. Vandervoort Walsh and Anselm Cefola, “Prestressed Concrete: Exploits Virtues of Steel and Concrete ... in Effect Creates a New Material,” *Architectural Record* 106, no. 2 (August 1949): 136-142.

⁸⁹ T.Y. Lin, “A Review of Prestressed Concrete in the U.S.A.,” *Constructional Review* 34, n. 10 (October 1961): 19-27.

⁹⁰ “The Norton Building, Seattle, Washington,” *Architectural Record* 128, no. 1 (July 1960): 131-136. See also “Four Office Buildings, Four Different Schemes,” *Architectural Record* 125, no. 4, (April 1959): 170.

⁹¹ T.Y. [Tung-Yen] Lin, “Tall Buildings in Prestressed Concrete,” *Architectural Record* 138, no. 6, (December 1965): 165-170.

⁹² “Engineers Achieve Surprising Savings by Post-tensioning Apartment Flat Plate Slabs,” *Architectural Record* 141, no. 6 (June 1967): 193-196.

handling, as new machines helped contractors reduce labour and increase safety. Machine-driven material handling helped to build taller structures due to the availability of crane booms, truck cranes, telescopic towers and more efficient methods of hoisting and conveying. The impact of mechanisation in America was reported by *Architectural Forum* in 1956, where, aside from the impact of site machinery, a promising future for the ready-mixed industry was envisaged due to the development of concrete-pumping machines.⁹³

Concrete technology in tall buildings advanced in the post war years due to progress in the field of automated formwork. Knowledge of these advanced systems developed from industrial applications and was then transposed into commercial high rise construction. The first method of automated formwork to find this type of new application was slip-forming.⁹⁴

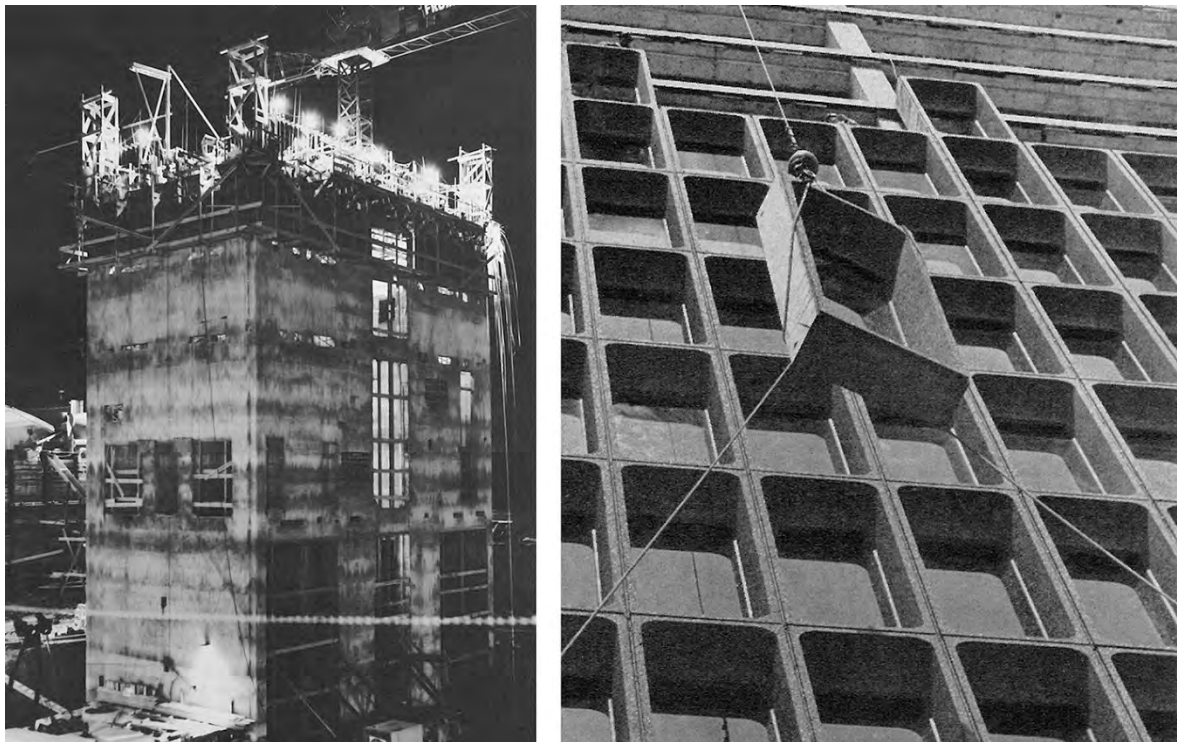


Figure 7.14

Slip-form mechanical core under construction at Pierre Laclede Building, St Louis, Missouri, 1964 (left) and pre-glazed precast concrete façade panels under construction at Phillips Petroleum Building in Bartlesville, Oklahoma, 1963 (right)

⁹³ "Technology: Automation in Construction," *Architectural Forum* 104, no. 2 (February 1956): 158-161.

⁹⁴ "Sliding Formwork: Multi-storey Concrete Wall Rises 20' a Day Between Continuously Moving Forms," *Architectural Forum* 97, no. 5 (November 1952): 150-152.

Slip-forming construction was a continuous, day and night, pouring procedure of concrete walls through a formwork and platform system that moved vertically. The platform would move slowly, on an ‘inch by inch’ pace, while being pushed upward by hydraulic screw-jacks fed through threaded rods inside the formwork. After the pour, the rods would become ‘lost’ in the reinforcement of the wall. Slip-forming originated in northern Europe (Sweden, Norway, Denmark and Germany) for building silos, water storage tanks and industrial towers. In 1955, *Architectural Record* announced the first application of slip-forming for a large building for “human occupancy”, the ten storey-high Madison Towers Hotel in Memphis.⁹⁵ There, slip-forming offered significant cost savings and reduced construction time. By the early 1960s, slip-form construction had advanced to be a most competitive alternative against steel for the construction of the service core in tall office buildings.⁹⁶

Rising costs associated with conventional *in situ* concrete construction - due to intensive labour on site - continued to encourage the adoption of new methods of mechanisation. Among these, innovation was sparked by adapting powerful lifting actuators, which were developed by NASA for the Saturn V rocket program and which opened the path for more efficient systems of vertical lifting with the potential to be used in suspended structures, movable formwork systems and rather futuristic lift-up slabs.⁹⁷

Integral architecture

Reaching to pour at height remained the major handicap of *in situ* concrete as the primary structural material in tall buildings. A more competitive alternative was offered by concrete prefabrication. From the late 1950s rapid advancements in the precast concrete industry resulted in comprehensive engineering systems also suitable for high-rise construction. One early built example, completed in Hawaii in the early 1960s, was based

⁹⁵ “Slip Form Construction Speeds Erection of Apartment Hotel,” *Architectural Record* 118, no. 4 (October 1955): 248. Earlier applications for apartment buildings had occurred in northern Europe as reported by *Architectural Forum* in 1952.

⁹⁶ “Slip-Form Core Speeds Mechanical Installation,” *Progressive Architecture* 44, n. 10 (October 1964): 156-159.

⁹⁷ “Construction Technology: Can New Lifting Systems Cut Construction Costs?” *Architectural Record* 139, n. 6 (June 1966): 203-204.

on the erection of precast “tree” structures used in combination with *in situ* lightweight concrete.⁹⁸

By the mid-1960s the technology of precast wall panels in office buildings became consolidated practice as an economic alternative to aluminium curtain wall construction.⁹⁹ A strategic point of development for the precast industry was reached with the development of façade units pre-glazed off-site with zipper gaskets, as used, possibly for the first time in 1963, in a tower designed by Welton Becket and Associates: the Phillips Petroleum Building in Bartlesville, Oklahoma.¹⁰⁰

The firm of I.M. Pei and Henry Cobb was among the forerunners of precast concrete know-how in America. In 1966, Araldo Cossutta, a partner at I. M. Pei and Partners, explained in a lengthy article in *Progressive Architecture* the design approach based on concrete as the primary structural and façade material.¹⁰¹ Cossutta described the method as a will to maintain architectural unity and integrity between envelope and structure. This approach depended heavily on trial and error and success depended on precise and smooth formwork systems, the integration of glazing in precast panels with ‘zipper’ neoprene gaskets and the development of new finishing methods to improve weathering, such as sandblasting.

This all-concrete approach moved deliberately in opposition to the more conventional approach of the ‘crystal box’ of glass curtain walls and steel skeletons. Cossutta’s philosophy of “integral architecture” did not stem from matters of aesthetics, but rather from the efficient integration between architecture and environmental services:

Shall we look behind the gleaming curtain wall panels or remove a portion of luminous hung ceiling? What we see there has little to do with the abstract purity and simplicity of the ‘crystal box’. In these shadowy regions, beams and girders, ducts, pipes, conduits, and wires criss-cross, interlace, and intertwine in a desperate attempt to reach destinations without interfering one another. And the higher the building standards, the greater is the squeeze, and, of course, the more costly end product. As I thought these problems, very obvious

⁹⁸ “High-rise Structures in Hawaii Combine Precast, Poured Concrete,” *Architectural Record* 130, no. 4 (October 1961): 176-181.

⁹⁹ Maurice Wolff, “Detailing a Precast Panel Façade,” *Architectural Record* 137, no. 3 (March 1965): 191-198. See also in the same volume and number “Three Precast Bearing Walls”: 218-220.

¹⁰⁰ “Precast Concrete Wall Frames Delivered to Building Preglazed,” *Architectural Record* 134, no. 1 (July 1963): 152-153.

¹⁰¹ Aldo [a.k.a. Araldo] Cossutta, “From Precast Concrete to Integral Architecture,” *Progressive Architecture* 47, n. 10 (October 1966): 196-207.

questions came to my mind. I wondered whether expert builders and real estate developers also ask themselves these questions.¹⁰²

7.4 The square plan tower in America

From block building to corporate form-giving

Block Building

These radical technological innovations on building materials and services were applied extensively in American tall buildings, starting from the post-war office building boom that took place, particularly, in New York.¹⁰³ In Manhattan, a new typology of air-conditioned workspace known as “block building” emerged in the city, setting precedents that questioned the existing building controls.¹⁰⁴ Office buildings of the “block” type made maximum use of deep space with footprints built over the full lot area. This typological idea stemmed from the concept of minimum wall for floor area ratio, which provided cost efficiency as well as better return prospects for the owner. Reducing envelope length against floor area increased revenue, and highlighted the economic potential of larger and squarer – rather than smaller and longer - floor plates:

The block building is (...) more economical to build and operate. Exterior walls are the most costly parts of any major structure. The larger the area of a building's floor, the less exterior wall will be required to enclose it. For instance, if a plan is 50 feet square, it contains 2,500 square feet of space, and its exterior wall is four times 50, or 200 linear feet. It thus contains 12.5 square feet for each foot of wall. But if the floor is 100 feet square, it contains 10,000 square feet of space and the exterior wall is 400 linear feet, or 25 square feet for each foot of wall. So the 100-foot-square building takes only half as much exterior wall per square foot of rentable area as the 50-foot-square building. There are other important savings. As heat losses are proportional to the area of the exterior walls, the cost of heating and air conditioning will be approximately 50 per cent less per square foot of floor area in the larger building. Window cleaning and maintenance of the exterior wall will be in proportion.¹⁰⁵

The typological principles of “block building” developed in response to a technological context where air conditioning was still in evolution. In 1947, the Universal Pictures Building, designed by Kahn and Jacobs Architects, had air conditioning plant designed with the “cooling effect of a column of ice six miles high and one foot square”.¹⁰⁶ The building footprint was rectangular, rising from the site boundaries for several floors, but

¹⁰² Cossutta, 204.

¹⁰³ “How Long Can a Boom Last?” *Architectural Forum* 99, no. 5 (November 1953): 45.

¹⁰⁴ Schultz and Simmons, *Offices in the Sky* (New York – Indianapolis: Bobbs-Merrill): 248-249.

¹⁰⁵ Schultz and Simmons, 249.

¹⁰⁶ “Built-in Air Conditioning,” *Architectural Record* 102, no. 4 (October 1947): 147.

the section had to set back to follow the built-form regulations of Manhattan. The setbacks posed severe limitations for the distribution of air supply. For the state of the art systems of the times, it was ideal to distribute air conditioning from a central plant along the perimeter of the building, where cooling loads were higher. Initial schemes contemplated air distribution with a peripheral system rising via the external walls, but the “ziggurat” envelope of the regulations made the solution not viable. Air distribution was achieved therefore from the interior of the building from small plant rooms or “control stations” located on each office floor.¹⁰⁷

Outside the regulatory constraints of Manhattan, the Employers Insurance Building in Dallas (George L. Dahl Architects and Engineers, completed in 1950) demonstrated the advantages of perimeter air distribution on a quasi-square corner block. The air conditioning ducts were housed inside vertical aluminium fins of the curtain wall, where air was distributed from a mechanical plant on the rooftop.¹⁰⁸

In 1950, the iconography of American multi-storey architecture was enriched by Frank Lloyd Wright’s Johnson Wax Tower. The tower was monolithic, square in plan and supported by a central core that clustered building services and circulation.¹⁰⁹ This tower, although not an office building, was, on the one hand, a symbol of the new glass aesthetic of “crystal towers”,¹¹⁰ but on the other hand, perhaps more significantly, it anticipated the development of a typological centre-core supported counterpoint to the glass-walled slabs of the early 1950s.

In New York, squarish “block building” blocks continued to challenge the “rampant zigguratism” during the 1950s, like, for example, with the cubic block on podium designed by William Lescaze at 711 3rd Avenue.¹¹¹ But, more pervasively, the epitome of the “new skyscraper” in Manhattan was the curtain-walled “slab”:

(...) expensive property dictates a tall building for adequate rental return; a ten-story building at Park Avenue and 50th would be a disaster. The added cost of constructing a higher tower is offset by the premium rentals the upper floors bring – such space is quieter

¹⁰⁷ “Built-in Air Conditioning,” 148.

¹⁰⁸ “Employers Insurance Building,” *Architectural Record* 108, no. 3 (September 1950): 101-105.

¹⁰⁹ “Wright’s Core-supported Tower Unveiled in Photographs,” *Architectural Record* 108, no. 6 (December 1951): 11-12.

¹¹⁰ “Our New Crystal Towers,” *Architectural Forum* 98, no. 2 (February 1953): 142-145.

¹¹¹ “711 Third Avenue Building,” *Architectural Record* 121, no. 3 (March 1957): 246.

and cleaner; offers daylight, privacy, prestige and a view. At any level, the area not more than 26 to 30 ft from daylight (inner plus outer office) pays larger rentals than dark space – hence the popular slab form. Constructing large area floors with much inside space (i. e. the zoning ziggurat) is in most cases penny-wise and pound foolish, for such space brings a lower rental in good times and in hard times possibly none.¹¹²

Thermal economics

In 1957, *Architectural Forum* reported the findings of a study done by Aladar Olgyay of Princeton University.¹¹³ The study discussed the economic implication of air conditioning in light of the pervasive use of glazed curtain wall slabs of the times. The authors put the terms of the problem as a “battle” between the “window wall” and the “hole in the wall”. The battle was exemplified by the two most iconic paradigms of the modern American skyscraper: the Lever House in New York – an uncompromisingly modern slab of stainless steel and glass - and the Alcoa Headquarters in Pittsburgh, which had a unitised façade of aluminium with “TV Windows” and a modest fenestration ratio of 25%. The study of Olgyay showed that severe heat-gains arising from all-glass walls compromised the benefits of air conditioning, bringing intolerable internal discomfort for employees.

The study correlated the ratio of opaque to transparent wall surfaces with the air conditioning tonnage required to sustain comfort for occupants and showed the pejorative effects that could derive from poor building orientation. In the best case, in order to minimise heating and cooling loads, a rectangular office had to be oriented with longer sides facing North and South. In any case, the study concluded that shading and double-façade screening devices were essential if the “openness” of modern design was to stay within limits of reasonable cost and thermal comfort.¹¹⁴

Another article in *Architectural Forum*, discussed the “intricate equation” at the base of design decisions pertaining to floor plan shape and orientation in office buildings.¹¹⁵ The search for the solution was complex, but the source of the problem was simple:

For every 100 sq. ft. of unshaded, unfavourably oriented glass used in a tall building in most parts of the US, an additional ton of air conditioning must be provided at a cost of \$300 to

¹¹² James S. Hornbeck, “A Review of the New Skyscraper,” *Architectural Record* 121, no. 3 (March 1957): 229.

¹¹³ Aladar Olgyay, “Thermal Economics of Curtain Walls,” *Architectural Forum* 107, no. 4 (April 1957): 154-161.

¹¹⁴ Olgyay, 158-161.

¹¹⁵ Henry Wright, “What Next for the Window Wall?” *Architectural Forum* 103, no. 2 (July 1955): 168-177.

\$800. (...) If every square foot of offending, unprotected glass adds about \$5 of air conditioning equipment to the *first cost* [sic] of the building, the architect is in a position to spend a considerable fraction of this on special glass, shading devices and other means for reducing air-conditioning load, since if such measures are effective they may reduce *operating costs* [sic] that is pure gravy. And by the same time he must be prepared to defend every foot of glass he does use, since glass anywhere on a building – except perhaps its north-facing side – in the era of air conditioned rental space has become a factor of real economic importance.¹¹⁶

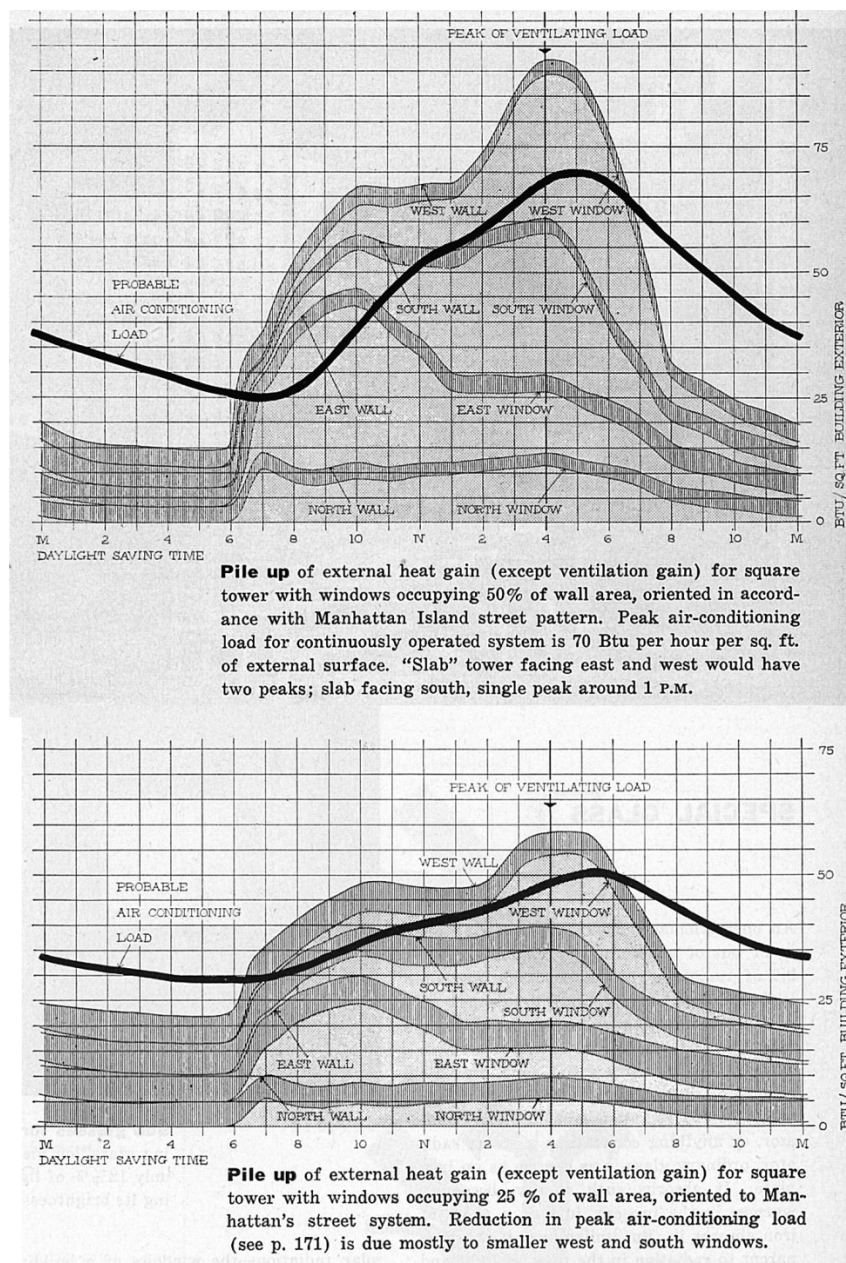


Figure 7.15

Pile up diagrams of peak air conditioning loads of square tower located in Manhattan with 50% glazed wall area (top) and 25% glazed wall area (below), from Henry Wright, *Architectural Forum*, 1957

¹¹⁶ Wright, 169.

An office building of the ‘slab’ type oriented facing east and west, such as it was the case, for example, of the United Nations Headquarters in New York, could cost a “good deal more” to be air conditioned than a “squarish tower”.¹¹⁷ Four design strategies were then identified in order to reduce air conditioning cost: building shape and orientation, smaller windows in critical areas, quality of glass and shading devices.¹¹⁸

The same article showed with analytic studies the optimal floor plan shape against heat-gain and revealed that square plan footprints would be a versatile option in different climatic conditions. A slab type oriented to face precisely north and south would offer optimal thermal performance, but any slight deviation from this ideal orientation would see slab types underperforming in comparison with square tower types. As an example to prove this point, the author presented the case of the Manhattan grid, which forced most buildings to align with the streets, rather than with the cardinal points, making the ideal, thermally-optimised slab facing north-south a rather difficult model to be applied in reality.¹¹⁹

From squarish to square

The debate about versatile all-round efficiency in American tall buildings was accompanied by a growing number of fully air-conditioned office buildings characterised by square or squarish office footprints and/or less façade openings. These projects started to appear abundantly in leading American periodicals of architecture, such as *Architectural Record* and *Architectural Forum*, from the mid-1950s onwards.

The Mile High Center in Denver (I.M. Pei, 1953-1956),¹²⁰ was reviewed as a “new kind of office building” that challenged the “accepted standards” of office building of the times.¹²¹ The tower was of a squarish plan with an offset centre core with peripheral distribution of air conditioning reticulated – and revealed – directly in the façade.

¹¹⁷ Wright, 169.

¹¹⁸ Wright, 170-175.

¹¹⁹ Wright, 175.

¹²⁰ “New Thinking on Office Buildings,” *Architectural Forum* 99, no. 3 (September 1953): 107-109. See also “The Impact of Mechanical Equipment on Design,” *Architectural Record* 115, no. 4 (April 1954): 204-205.

¹²¹ “Denver’s Mile High Center,” *Architectural Forum* 103, no. 5 (November 1955): 128-137.

The building of Capitol Records in Hollywood, California (Welton Becket & Associates, 1955-56),¹²² reached economic efficiency with a minimal wall area due to its circular plan and featured a façade protected by sunshades all around. The circular shaft of 90 feet diameter allowed “quicker interoffice travel” and a net to gross floor plan efficiency of 86%.

The Union Carbide Building in New York (Skidmore Owings Merrill New York, completed in 1960),¹²³ was considered a “pacesetter” and one of the new “Park Avenue prototypes” of the American skyscraper due to an innovative method of air conditioning reticulation in the ceiling that was skilfully hidden behind translucent vinyl tiles. The quasi-square plan shape (a 3 to 4 aspect ratio of approximately 130 x 160 feet size) was determined by client request and allowed reaching of additional height due to a tower footprint reduced to a quarter of the site area.¹²⁴ The Equitable Life Home Office in Chicago (Skidmore Owings Merrill Chicago, completed in 1962) was, with one and a half million square feet, the “largest office building occupied solely by its owners”, a highly flexible “workshop” similar to the Union Carbide in concept and appearance.¹²⁵

The Blue Cross Blue Shield Building in Boston, (Paul Rudolph, completed in 1960), was a 100 feet square floor plan tower, where the peripheral air conditioning system was integrated within a façade of precast concrete mullions, which expressed an ‘inside out’ sculptural aesthetic where the logic of mechanical reticulation was used as the generator of façade form. The square plan had its service core offset, creating a 60 feet deep space in the centre of the floor plate.¹²⁶ A similar plan layout was used at the Michigan Consolidated Gas Headquarters in Detroit (Minoru Yamasaki, 1960-1963). The façade was dominated by verticality with densely spaced tree-like mullions of white quartz precast concrete. The plan of approximately 125 feet square had core offset on one side, creating a 60 feet deep central space.¹²⁷

¹²² “Built in the Round for Economy,” *Architectural Forum* 105, no. 5 (November 1956): 155.

¹²³ “The Current Pacesetter,” *Architectural Record* 128, no. 5 (November 1960): 155-162.

¹²⁴ “Toward Greater Ceiling Flexibility,” *Architectural Record* 127, no. 2 (February 1960): 220-224.

¹²⁵ “Planning Leads to Flexibility, Economy,” *Architectural Record* 131, no. 5 (May 1962): 182-184.

¹²⁶ “Inside Out Office Building,” *Architectural Record* 128, no. 6 (December 1960): 111-116.

¹²⁷ “Yamasaki’s New Expression of Aspiring Verticality,” *Architectural Record* 128, no. 2 (August 1960): 141-146. See also “Yamasaki’s First Skyscraper,” *Architectural Record* 133, no. 5 (May 1963): 143-149.

The Hartford Building in Chicago (Skidmore Owings Merrill Chicago, completed 1961),¹²⁸ was “constructed to provide rental return as well as owner occupancy” with an “almost square (...) plan (7 by 9 bays) to reduce peripheral area”. A conventional aluminium curtain wall was recessed behind a sun shade used to reduce air conditioning loads. The footprint was 190 x 150 feet with a 62 feet deep space punctuated by columns in a 22 feet square structural grid.

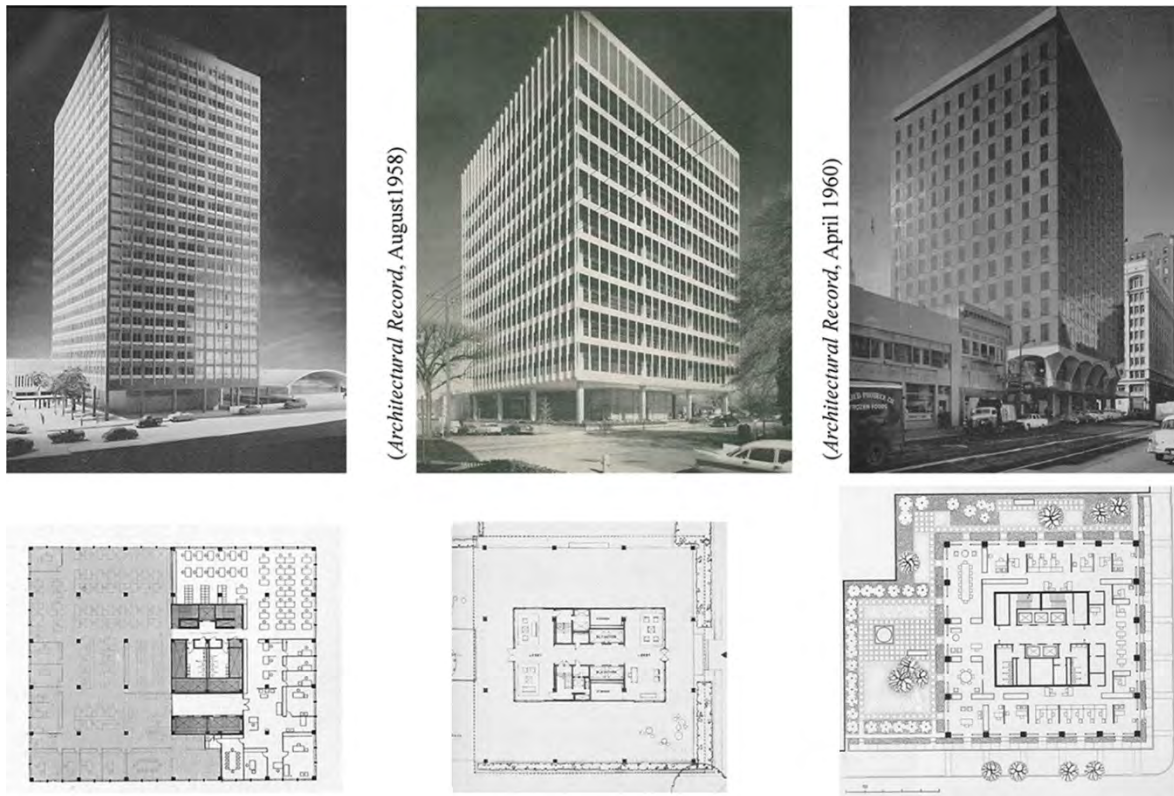


Figure 7.16

American monolithic square or squarish office towers of the 1950s: Mile High Center, Denver, Colorado, 1954 (left); Warren Petroleum Building, Tulsa Oklahoma, 1958 (middle); John Hancock Western Home Office, San Francisco, California, 1960 (right)

The Tishman 615 Building in Los Angeles (Victor Gruen Associates in association with Daniel Mann Johnson and Mendenhall, completed in 1961),¹²⁹ was the tallest of the city at the time of its completion. Blue glass mosaic tiles were set on prefabricated precast panels

¹²⁸ “Institutional Character at a Competitive Cost,” *Architectural Record* 130, no. 3 (September 1961): 121-125.

¹²⁹ “Colourful High-rise is Tallest in L.A.” *Architectural Record* 130, no. 4 (October 1961): 139-141.

with punched windows. The tower was almost square in footprint, 140 by 120 feet, with internal space up to 45 feet deep and punctuated by mid-span columns.

A perfectly square plan shape and centre core with column-free space was used at first on smaller buildings, such as the twelve storey-high Warren Petroleum Building in Tulsa, Oklahoma (Skidmore Owings Merrill Chicago, completed in 1957). A double façade, with an external skin set back 5 feet from the edge of the building, reduced heat loads with dark heat-absorbing glass fixed above the sight line. The building was praised for the efficient air conditioning system that performed under a “blazing south-west sun”. The footprint was 108 feet square with an unobstructed clear depth of 36 feet between the core and the façade.¹³⁰

The John Hancock Western Home Office in San Francisco (Skidmore Owings Merrill San Francisco, completed in 1959)¹³¹ had concrete load bearing external walls, with 50% open punched windows on precast concrete cladding of granite aggregate. Hunched arches at the first two floors transferred loads from the tower to a colonnade set back at street level. The tower was exactly square in plan (approximately 110 feet wide) with 30 feet column-free space between façade and core. The building was radical and sober. It was the fruit of the individualist genius of Chuck Bassett. Considered as an “intentionally bad” design in counter-tendency to the pervasive aesthetics of the time, the project was subject of strong internal criticism at SOM.¹³²

A plan perfectly square was used for the Libbey-Owens-Ford Headquarters in Toledo (Skidmore Owings Merrill New York, 1958-1960). The project, the headquarters of a major glass manufacturer, aimed to demonstrate the opportunity to use extensive glazing (double-glazed Thermopane units) without compromising the economic operation of high-velocity air-conditioning. The plan had a service core offset internally, which gave flexibility of layouts catering for private offices of large to medium size, ‘shallow’ secretarial space and ‘deep’ space for typists. *Architectural Record* reviewed the fully glazed square tower as a rare exemplar of “total” architecture:

¹³⁰ “Unique Double Skin Functions Well – Looks Good,” *Architectural Record* 124, no. 3 (August 1958): 152-158.

¹³¹ “John Hancock Western Home Office,” *Architectural Record* 127, no. 4 (April 1960): 204-206.

¹³² Richard Foster, interview, Melbourne, 11 December 2013.

What comes out, finally, is complete architecture (it has been called total by some) which was quite usual in other periods of history, but not so common these days. The building was designed by the architects from the overall concept to its smallest detail. In this case, the design has been concerned not only with emotional content, but with technology, not with concept of function alone, but with a workable blending of both.¹³³

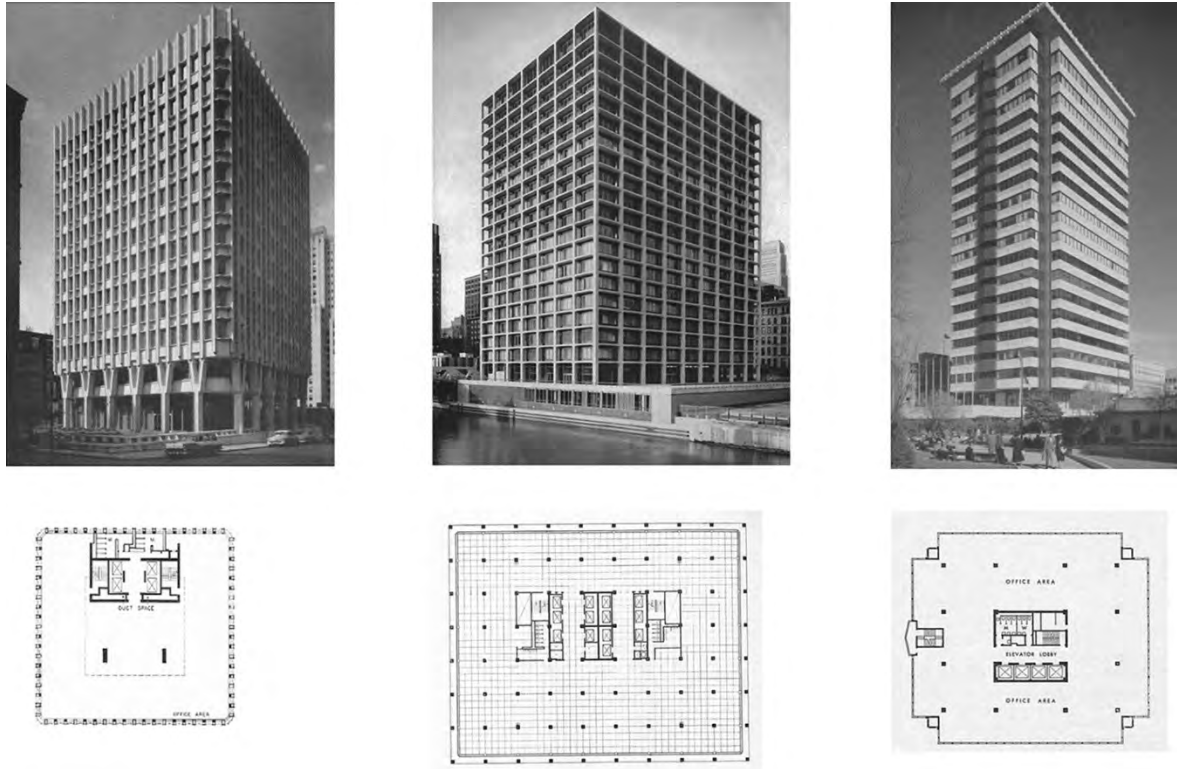


Figure 7.17

American monolithic square or squarish office towers in of late 1950s and early 1960s: Blue Cross – Blue Shield Headquarters, Boston, Massachusetts, 1960 (left); Hartford Building, Chicago, Illinois, 1961 (middle); International Building, San Francisco, California, 1962 (right)

Structural expression and ubiquity

During the 1960s and through the 1970s, the model of the fully air conditioned square, or squarish, plan tower in the USA transitioned from the phase of experimental genesis to that of a ubiquitous apogee, which reached also Canada, and where the type was applied to tall office buildings of growing footprint and building height and where space was deep and preferably column-free.

¹³³ “Executive Office Building, Libbey-Owens-Glass Co.” *Architectural Record* 128: 188.

The CBS Building in New York (Eero Saarinen, completed in 1965),¹³⁴ followed the trend of bulky skyscrapers with closely spaced external piers and almost square plan - 156 by 130 feet. The tower alternated open and solid columns at a 5 feet module, where recessed areas were used for air conditioning distribution. Mechanical services were highly coordinated and included an innovative approach for the induction units, which were 'sunk' into the floor to maximise rentable space. The structure was all concrete and clad in precast concrete panels with Canadian Black granite. A two-way concrete floor plate was used with the claim that it was less expensive than steel-framing.¹³⁵ Structural optimisation was reached - making pioneering use of electronic computation - to achieve a 36 feet column-free span from core to windows.¹³⁶

The theme of column free span was prominent in the Tenneco Building in Houston (Skidmore Owings Merrill San Francisco, completed in 1973). The project was a fine-tuned development of Bassett's square in a square theme experimented in the San Francisco's John Hancock Western Home.¹³⁷ The Tenneco Building had a 190 square feet footprint, building envelope protected by sunshades and 45 feet deep clear span space surrounding a square service core. In 1963, it was the "widest clear-span between core and external columns of any building yet constructed".¹³⁸

The IBM in Seattle (Minoru Yamasaki, 1963-1965)¹³⁹ had load-bearing tube pipes clad with precast concrete panels that transferred loads at ground floor through marble clad steel arches. The building was exactly square in plan with 113 feet wide footprint and 34 feet space depth, and it was covered in densely spaced aluminium cladding and internally-glazed windows, a similar feat of Yamasaki's first skyscraper, the Michigan Consolidated Gas in Detroit.

¹³⁴ "Saarinen's Skyscraper," *Architectural Record* 138, no. 1 (July 1965): 75, 112-118.

¹³⁵ Bethami Probst, "CBS: Sombre Power on Sixth Avenue," *Progressive Architecture* 46, no. 7 (July 1965): 187-192.

¹³⁶ Matthys P. Levy, Paul Weidlinger and Charles P. Lecht, "The Role of the Computer in Engineering Practice," *Architectural Record* 134, no. 2 (August 1963): 189.

¹³⁷ Richard Foster, interview, 11 December 2013.

¹³⁸ "The Evolution of the High-rise Office Building," *Progressive Architecture* 44, no. 9 (September 1963): 146-157.

¹³⁹ "Structure Plays Leading Role in Latest Yamasaki Designs," *Architectural Record* 134, no. 6 (December 1963): 104-105; "Bearing Wall Expressed in a Skyscraper," *Architectural Record* 137, n. 2 (February 1965): 97, 124-128.

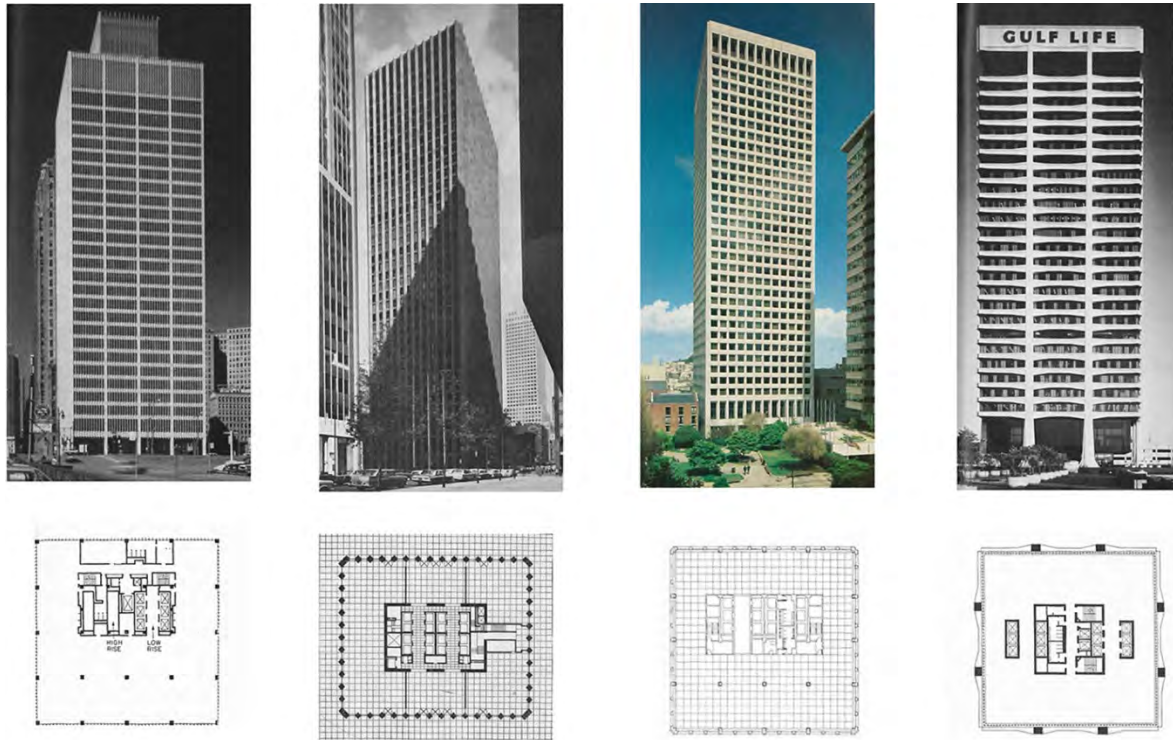


Figure 7.18

American monolithic square or squarish office towers of the 1960s: Consolidated Gas Company Headquarters, Detroit, Michigan, 1963 (left); CBS Building, New York City, New York, 1965 (middle left); Hartford Plaza, San Francisco, California, 1967 (middle right); Gulf Life Tower, Jacksonville, Florida, 1968 (right)

Yamasaki's twin towers of the World Trade Centre were also based on the square plan, column free type. The towers were an eloquent demonstration of the structural expression of the "modern bearing wall" defined by William Le Messurier,¹⁴⁰ where gravity loads were shared with the core, but the lateral loads were taken only by the external walls. Yamasaki's acrophobic fenestration reappeared with a dense module of 3 feet and 3 inches. The twin towers were the ultimate example of square plan skyscrapers for height and size with footprints over 200 feet wide and deep space that reached column-free up to 60 feet from the façade line.

The tall structural emphasis of square plan landmarks continued and became pervasive in Northern America in the second half of the 1960s with projects such as Place Victoria in

¹⁴⁰ "The Tallest Steel Bearing Walls," *Architectural Record* 135, no. 3 (March 1964): 194-196.

Montreal,¹⁴¹ the Standard Oil Building in Chicago,¹⁴² the First National Bank in Seattle,¹⁴³ and the Knights of Columbus Building in New Haven.¹⁴⁴

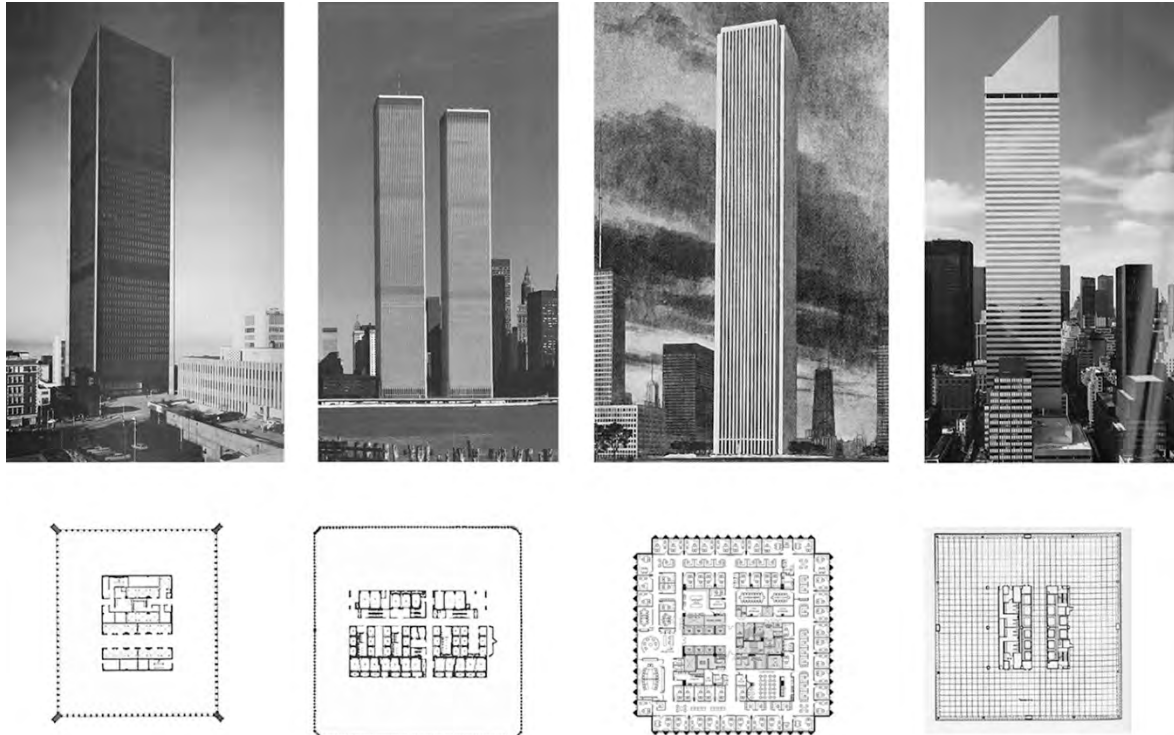


Figure 7.19

American monolithic square or squarish office towers of late 1960s and 1970s: First National Bank, Seattle, Washington, 1970 (left); World Trade Center, New York City, New York (middle left); Standard Oil Building, Chicago Illinois, 1970 (middle right); Citicorp Tower, New York City, New York (right)

In the 1970s, the square plan monoliths continued to show a versatile and ubiquitous appeal through-out the United States ranging from smaller to large projects, generating new structural concepts such as the Sears Tower in Chicago and populating the skylines of several and different metropolitan contexts.¹⁴⁵ In American periodicals, during the 1960s and 1970s, examples of the type continued to be showcased, such as – among others - the Prudential Tower in Boston,¹⁴⁶ Hartford Plaza in San Francisco,¹⁴⁷ the Gulf Tower, in

¹⁴¹ “High-rise Montreal Financial Center by Nervi, Moretti,” *Architectural Record* 131, no. 5 (May 1962): 189-190; “Moretti and Nervi’s Place Victoria,” *Architectural Record* 139, no. 3 (March 1966): 141-146.

¹⁴² “Buildings in the News,” *Architectural Record* 147, no. 3 (March 1970): 40.

¹⁴³ “Seattle’s ‘Tall One’” *Architectural Record* 147, no. 6 (June 1970): 129-136.

¹⁴⁴ “Knights of Columbus Headquarters, New Haven and New Haven Coliseum,” *Architectural Record* 135, no. 3 (March 1964): 166.

¹⁴⁵ “Buildings in the News,” *Architectural Record* 144, no. 4 (October 1968): 40-41.

¹⁴⁶ “Office Building Complexes,” *Architectural Record* 135, no. 3 (March 1964): 190-191.

¹⁴⁷ “Hartford Plaza and Old St Mary’s Rectory,” *Architectural Record* 141, no. 5 (May 1967): 131-138.

Jacksonville (Florida),¹⁴⁸ the Hoffmann-La Roche Headquarters in Nutley (New Jersey),¹⁴⁹ the Citizens Bank Center in Richardson (Texas),¹⁵⁰ and the Renaissance Center in Detroit.¹⁵¹

Crisis and the cost-quality paradox

The diffusion of square plan towers in America was the morphological equivalent of a technological trend where more shading control and opacity were preferred in building envelopes. Interest in façade technological innovation emerged particularly in the 1960s. At first with the diffusion of precast concrete panelling, then with advancements in façade materials, such as reflective glass, and environmental engineering progress in wind resistance, aerodynamics and air and water tightness.¹⁵²

Demand for energy saving in building operation was accelerated by the energy crisis of the 1970s and by the ensuing debate that followed. In North America, the Oil Crisis worked as a catalyst for innovation in façade systems of higher quality and performance. Growing shortages of fuel and electricity constrained the building industry and led to the new mentality of design for “energy conservation”, which was not focussed solely to reduction of running costs for air conditioning, but verged towards the awareness of environmental concerns at a global scale.¹⁵³

From the late 1960s, in a context of ever-growing running costs in commercial buildings, American architects became aware of a design approach that *Architectural Record* defined as the “cost quality paradox”.¹⁵⁴ The paradox was that tall office building façade design, notwithstanding the economic imperatives inherent of the building typology, was being

¹⁴⁸ “Image and Elegance in Precast Concrete,” *Architectural Record* 143, no. 3 (March 1968): 137-142.

¹⁴⁹ “Skillful Planning and Detailing Gives Real Flexibility to an Office Building,” *Architectural Record* 144, no. 1 (July 1968): 121-126.

¹⁵⁰ “A Bold Structural System Creates a Strong Yet Serene Image,” *Architectural Record* 158, no. 1 (July 1975): 131-136.

¹⁵¹ “Buildings in the News,” *Architectural Record* 154, no. 3 (September 1973): 40-41.

¹⁵² “Wind, Sun, Rain and the Exterior Wall,” *Architectural Record* 142, no. 3 (September 1967): 205-216.

¹⁵³ “A Round Table on Energy Conservation through Higher Quality Building,” *Architectural Record* 151, no. 1 (January 1972): 97-104. Energy crisis and conservation are also discussed recurrently in the editorials of Walter F. Wagner Jr: “Energy Conservation a Potential Disaster Starts Getting the Attention it Deserves,” *Architectural Record* 152, no. 3 (September 1972): 9-10; “Energy Conservation: Random Thoughts on Getting On with the Job,” *Architectural Record* 154, no. 1 (July 1974): 9-10.

¹⁵⁴ “Office Buildings – The Cost Quality Paradox,” *Architectural Record* 141, no. 6 (June 1967): 171-174.

gradually liberated from the constrictions of “cheapness and standardization”.¹⁵⁵ The relative cost of air conditioning installations continued to increase throughout the 1960s. By contrast, the cost of envelopes did not increase as steadily, making any effort to achieve savings on façade systems and materials a “less impressive” value management option than savings on air conditioning. On the contrary, any marginal cost increase due to the architectural quality of the façade seemed, more likely, an investment justified by the potential advertising factor given by differentiation in an office market saturated by homogeneity and anonymity. Another important aspect that fed into the cost quality paradox was related to new mechanisms of finance: “lenders want tenants who want quality buildings” and “want to know who is going to be the major tenants of a building before a commitment to finance is made”.¹⁵⁶

In the 1970s, these instances surrounding the Oil Crisis were accompanied by a cultural shift in architectural design, which led to the rise of post-modernism. Radical changes affected the design approach of American architects towards office buildings from the 1970s. The American writer and architectural critic Tom Wolfe – with a critique that was echoed in Australian media - identified with eloquence a point of change in skyscraper aesthetics that started in late 1970s and continued throughout the 1980s:

[In 1978] Philip Johnson released renderings and models of his new, corporate headquarters for AT&T, to be constructed on Madison Avenue in New York. It became the most famous unbuilt building of the 1970s. The most devoted Miesling of them all had designed a building with a top that seemed to have been lifted straight off a Chippendale highboy [...] But Johnson (...) managed to let the faithful know that in such areas as his attitude towards the client, he remained the classic modernist. He told how his client, AT&T, had been ‘so perspicacious, that they gave us a clue. They said: please don’t give us a flat top’.¹⁵⁷

Corporate form-giving

In the second half of the 1970s, a few landmark skyscraper projects in America signalled the beginning of a phase of decline of square or squarish centre core towers, which until then had been conceived generally with monolithic volumes and flat tops. A new generation of tall building emerged from the same typological footprint, but with three alterations: a return to all-glass envelopes (reflective), less purist floor plan shapes

¹⁵⁵ “Office Buildings – The Cost Quality Paradox,” 171.

¹⁵⁶ “Office Buildings – The Cost Quality Paradox,” 174.

¹⁵⁷ Tom Wolfe, “The fate of apostasy,” *The Age – Monthly Review*, February 1, 1982, 14.

(enriched by re-entrants, cruciform layouts, facets, setbacks, hybrid forms) and roof top features (crowns, tapering, pediments, spires).

The Citicorp Building in New York was announced as a “proud and soaring thing” in the tradition of Louis Sullivan.¹⁵⁸ The architect, Hugh Stubbins, was called to use large resources of private capital investment with a spirit “reinforced by moral and social ideas to develop a new generation of office buildings”.¹⁵⁹ The tower was square in plan, 152 feet wide, served by a centre core, but corners were overhanging at the base, cantilevering 72 feet from columns set at mid-point on each side of the square. Stubbins’ initial concept envisaged a side core plan. Due to concerns of rentability of such an innovative scheme, at a time when “New York office space was going begging”, the side core concept was ruled out by the owner, Citicorp, in favour of a more “conventional” centre core scheme.¹⁶⁰ The Structural engineer, William Le Messurier, favoured also the square central core, which permitted “a clean design” that he considered “very economical in its use of structural steel”.¹⁶¹ The building was terminated with a distinctive sloped crown. The crown was conceived initially to house apartments and then solar panels that promised energy savings, but the latter resulted to be less energy-efficient than envisaged and these ideas were abandoned.¹⁶² The 160 feet high crown was retained in the final project to house the first tuned mass damper ever conceived and installed in a tall office building.¹⁶³

Characteristic of the development of the American skyscraper of the 1970s was the adoption of reflective glass, which caused a return to all-glass tall architecture. The rise of a new corporate design philosophy that arose from reflective glass was commented upon by *Architectural Record*, which took some office projects designed by Daniel Mann Johnson and Mendenhall Architects (DMJM) as exemplars of this new aesthetic trend.¹⁶⁴ DMJM’s work with reflective glass of the 1970s ranged from compact, economic and

¹⁵⁸ “Buildings in the News - Office, Shopping Complex for New York,” *Architectural Record*, vol. 154, n. 3, (September 1973): 39.

¹⁵⁹ Mildred F. Schmertz, “Citicorp Center: If You Don’t Like Its Crown, Look at Its Base,” *Architectural Record* 163, no. 6 (June 1978): 107-116.

¹⁶⁰ Schmertz, 114.

¹⁶¹ Schmertz, 115-116.

¹⁶² “Nine examples of effective architect-engineer collaboration,” *Architectural Record*, vol. 160, n. 3, (Mid-August 1976): 66-71.

¹⁶³ Schmertz, “Citicorp Center,” 116.

¹⁶⁴ Michael Franklin Ross, “The Development of an Esthetic System at DMJM,” *Architectural Record* 157, no. 5 (May 1975): 111-117.

efficient purist plans to plan shapes enriched by curved and hybrid forms. The concept of the reflective envelope was considered by the architects as a membrane, non-directional and non-gravitational: “the exterior skin does not reflect the organization of the interior functions. It is neither a structural system nor a bearing wall system. The lightweight skin enclosure, however, is a non-gravitational system – flexible enough to wrap around any function”.¹⁶⁵

The typological mutations of a new generation of office buildings became evident with the work of Philip Johnson and John Burgee, and particularly with tall projects commissioned by the developer Gerald D. Hines, such as Pennzoil Place Houston.¹⁶⁶ The twin tower complex of Pennzoil was carved out of a square block of land in Houston, where Johnson juxtaposed two trapezoidal footprints separated by a “ten foot slit”. Each tower culminated with a forty-five degrees slant at the roof top.¹⁶⁷ The collaboration between architect and developer demonstrated the economic benefit arising from the cost-quality paradox. Pennzoil Place was designed and built as a speculative project after pre-letting to a major tenant. At the same time, the project was developed as a unique design with the direct involvement of the future tenants. Philip Johnson explained with eloquence and awareness the emerging philosophy of new commercial design: “paying a little more at the front-end can result in *getting back* [sic] a whole lot more in the long run.”¹⁶⁸ At Pennzoil Place, the quality premiums of the sloped top and of the neatly detailed air-tight design of the all-glass reflective envelope accounted only to 25 cents per square foot. Johnson, nonetheless, remarked an ongoing typological interest for “basic prismatic shape”:

This [kind of] shape can enclose room succinctly and leave room for sparing innovation at the same time. And [this kind of] shape acts as a marketing implement. The only way you *do* [sic] pay for innovation is if you don’t rent the space fast enough. The only way you *do* [sic] take a risk is if you settle for standards of design that result in the cutting of costs, or of corners, in such a way that a building ends up looking like any other building and, because of all that cutting, costing more to operate and maintain in the long run.¹⁶⁹

The rise of these new design trends was helped by the steady growth of white collar employment, which drove an unprecedented office building boom in the United States,

¹⁶⁵ Ross, 111.

¹⁶⁶ William Marlin, “Pennzoil Place,” *Architectural Record* 160, no. 6 (November 1976): 101-110.

¹⁶⁷ Marlin, 103.

¹⁶⁸ Marlin, 105.

¹⁶⁹ Marlin, 110.

when occupancy rates soared to a historical record of 96% in 1979.¹⁷⁰ The philosophy of tall corporate “form-giving” spread through the 1980s with a stream of tall building designs that involved most leading American architects,¹⁷¹ seeing existing firms like SOM to seek a “new direction”,¹⁷² and allowing new firms, such as Kohn Pedersen Fox to emerge as new skyscraper specialists by adopting the new lexicon of reflective glass, hybrid geometries and historical citation.¹⁷³

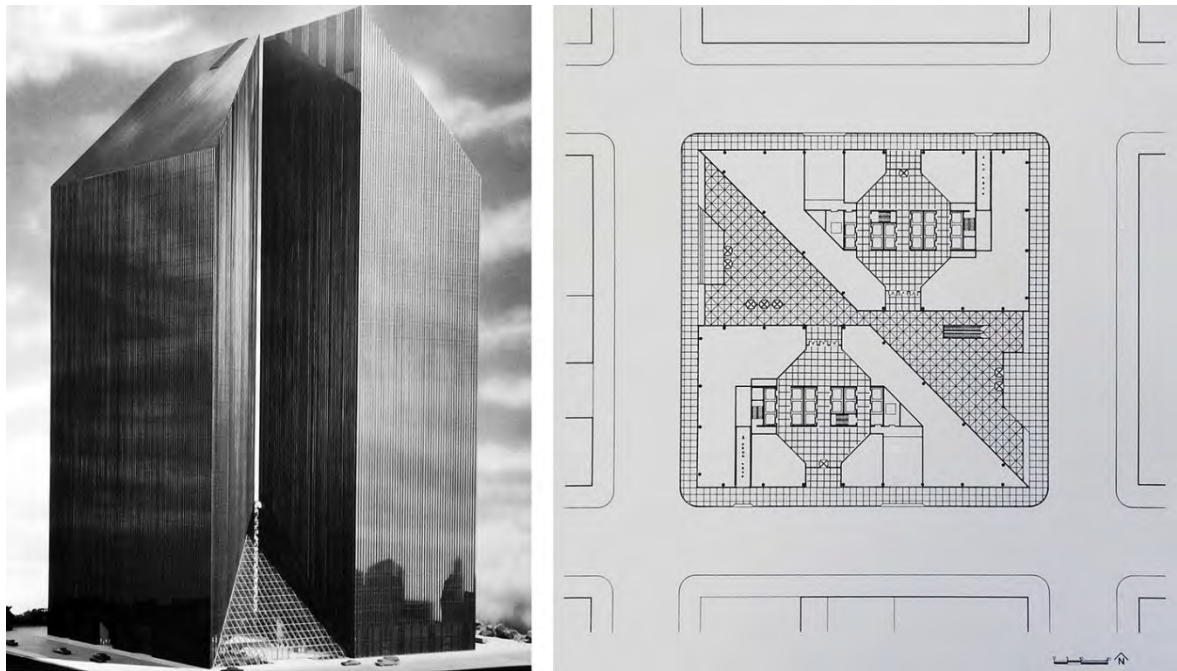


Figure 7.20

Pennzoil Place, Houston, Texas, completed in 1976; model and site plan

The iconic apogee of this new design sensibility was reached in the mid-1980s, and it was well summarised by Johnson’s notorious motto that architecture should “rather be interesting” than aligned to orthodox canons of homogeneity.¹⁷⁴ The typological essence of simplicity and straightforwardness of the square plan centre core tower, however,

¹⁷⁰ Thomas E. Kavet, “White Collar Employment: Impetus Behind the Office Building Boom,” *Architectural Record* 166, no. 6 (June 1979): 65.

¹⁷¹ “Corporate Form-givers,” *Progressive Architecture* 60, no. 7 (July 1979): 55-59; Janet Nairn, “News Report – Seven Architects Convene at the Museum of Modern Art to Discuss ‘Super-building’,” *Architectural Record* 169, no. 4 (April 1981): 35.

¹⁷² Janet Nairn, “Skidmore, Owings & Merrill’s New Directions in High-rise Design,” *Architectural Record* 169, no. 3 (March 1981): 114-132.

¹⁷³ Jim Murphy, “Cornering the Loop,” *Progressive Architecture* 64, no. 10 (October 1983): 78-83.

¹⁷⁴ Susan Doubilet, “I’d Rather Be Interesting,” *Progressive Architecture* 62, no. 10 (October 1984): 65-69 and “Not Enough Said,” 70-75.

continued. In some instances the type was recycled behind a pseudo-historicist post-modernist dress, such as in Michael Graves' Portland Municipal Services Building (Portland, Oregon, completed in 1982).¹⁷⁵ In other instances, a variant of the type based on a 44 metre wide footprint was disguised behind generous use of reflective glass facades articulated with setbacks, cruciform re-entrants, pinnacles and faceted perimeters. Significant exemplars of this postmodern transmutation of the purist monolithic centre core tower are Johnson and Burgee's designs of the headquarters of PPG in Pittsburgh,¹⁷⁶ and the Transco Tower in Houston.¹⁷⁷

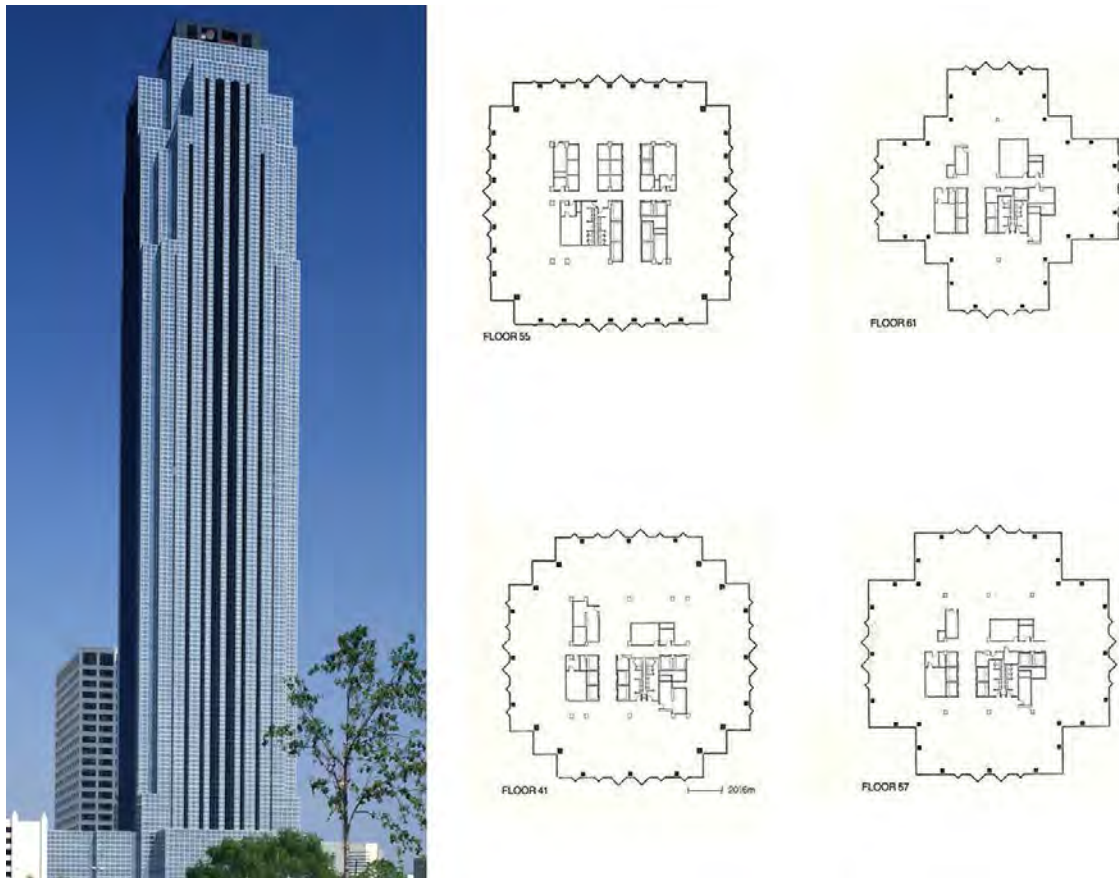


Figure 7.21

Transco Tower, Houston, Texas, completed in 1982; external view and typical floor plans from low rise to sky rise

¹⁷⁵ Eleni Constantine, "The Case for Michael Graves' Design for Portland," *Architectural Record* 168, no. 2 (August 1980): 96-101. See also: Douglas Brenner, "Portland," *Architectural Record* 170, no. 13 (November 1982): 90-95.

¹⁷⁶ "Buildings in the News – Pittsburgh to Have a New Johnson/Burgee Downtown 'landmark'," *Architectural Record* 66, no. 1 (July 1979): 41; Franklin K.B.S Toker, "PJ and PPG: a Date with History," *Progressive Architecture* 60, no. 7 (July 1979): 60-61.

¹⁷⁷ Jim Murphy, "It Towers," *Progressive Architecture* 62, n. 10 (October 1982): 94-97.

Conclusion

In the first two chapters it was assumed that there are speculative economic laws that govern the feasibility of tall buildings, and that these laws can be taken as a *conditio sine qua non* for office buildings, which are generally destined for occupancy by rental. In Melbourne, from the mid-1950s to the mid-1990s, these laws were applied architecturally to a large number of tall buildings, which grew and developed according to an idea of space quality given, above all, by all-round access to views, column-free space and the artificial control of climate indoors. The architectural type that satisfied more resiliently and more successfully this notion of office space quality in the Australian city was the square plan tower serviced – and in good part structurally supported – by a central service core.

This notion of commercial space quality, however, did not develop simply within the specific coordinates of place and time of Melbourne between the mid-1950 and the 1990s. American influences in Melbourne, in fact, were not simply mediated by periodicals, local architects and technological transfers and parallels, but stemmed from a direct involvement of leading American architects, who designed a handful of landmark buildings in the city.

Moreover, design practice that pertained to Melbourne, was associated with a set of laws about architectural quality that could be seen as universal, or at least with an international significance shared between North America and Australia. The origin of these laws can be tracked down from American commentaries of architects and developers, in particular from New York and Chicago, which were written in the late 1800s and in the first half of the 1900s. As early as 1924, Leo Sheridan, a real estate developer based in Chicago, had sketched a comprehensive set of rules for the design of modern tall office buildings. Architectural quality stemmed from a broad notion of efficiency in design that depended on qualitative as well quantitative factors such as size and squareness of the land parcel, regular geometry of the floor plate, ability to draw prestigious tenants, ratio of net to gross area, ratio of external wall to floor area, balance between rental and building height premiums, and layout and performance of passenger lifts.

These quantitative and qualitative notions of architectural quality, known as the Sheridan-Karkow formula, converged after World War II with some radical technical changes in

building materials (steel, aluminium, glass and concrete) and services (air conditioning, PSALI and lifts). Technological changes in turn interacted with architectural typology causing new building types to emerge. For example, once incandescent lighting was replaced by fluorescent tubes, which were characterised by lower heat output and energy consumption, the combination of air conditioning and cooler lighting opened the opportunity for exploring workspace beyond the 25 feet depth, which, until then, was considered as the internal boundary of space quality in office buildings.

The progress in building services that sparked new spatial models of tall office building design was paralleled by innovation in building materials that changed radically the methods of high rise construction. In the USA, after World War II, technological changes driven by military demand flowed into the civil construction industry, and soon after the end of the conflict, advancements in building materials were adopted by a new generation of skyscrapers. The entity of this technological transfer was international, and caused strategic developments in material manufacturing and methodologies of construction. These changes affected the four basic materials that are preponderant in modern commercial architecture: steel, concrete, aluminium and glass. Similar patterns of technological change – as discussed in Chapter 6 – also affected the Australia building industry in the mid-1950s and contributed to the growth of modern skyscrapers in Melbourne and Sydney.

The simultaneous introduction in the American building industry of technical advancements in structural materials, building envelopes and building services was behind the radical transformation of the aesthetics and typology of American skyscrapers. According to pervasive historiographical interpretations, the paradigm of the post-WWII American skyscraper was the curtain wall slab of buildings such as the United Nations Headquarters and the Lever House in New York. But soon after these paradigms were built, the typological success of the glazed curtain slab was put under scrutiny by developers, mechanical engineers and architects involved in the design of American tall office buildings.

From the architectural journals of the times, a debate on the thermal implications of the curtain wall, particularly in tall buildings, emerged from the mid-1950s and it was rejuvenated, two decades later, by the energy crisis of the 1970s. The discussion centred on

the economic problem brought about by initial and running costs of air conditioning. This problem was discussed particularly *vis-a-vis* factors of plans shape, orientation, envelope materials and other devices used to reduce solar heat gains.

These concerns, interweaving economic, technological and energetic efficiency, were accompanied by the emergence of a typological model that sought to optimise envelope length in relation to rentable area with suitable architectural quality. The trajectory of evolution of this building type is evident through exemplars published in American architectural periodicals such as *Architectural Record*, and also, in good part, by *Architectural Forum* and *Progressive Architecture*. The projects published in these periodicals indicate a trend, from the 1950, where square or ‘squarish’ tower blocks were built with massive materials (precast concrete), less fenestration and/or high-performance glazing (double glazing or reflective glass) with the scope of minimising cooling loads. This building type reached a peak of architectural media coverage in the 1960s and 1970s as a model of ‘total’ or ‘integral’ architecture where space, envelope, services and structure were cohesively unified into a typology suitable to be scaled up or down according to programmatic requirements and different urban contexts.

This model survived, in its typological essence, in the post-modern age, although with a significant transmutation that eliminated its monolithic appearance. Square plan, centre core towers with column-free space continued to be conceived by American architects and developers through the 1980s, albeit with subtle modifications of the top and of the envelope. These alterations were allowed by a ‘cost quality paradox’, which subverted the economic logic – originated at the time of Sheridan – according to which the building envelope area of an office building should be minimised simply in order to reduce construction cost. Greater awareness and concerns about running costs, which originated in the 1950s, were reinforced by the Oil Crisis of the 1970s. The latter led, as a paradox, towards a compositional liberation, where more expense on architectural quality – not only of the interior space, but also of the envelope – made sense as an advertising stratagem to differentiate speculative buildings, seeking to appeal corporate anchor tenants through aesthetic diversity.

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Discussion

The post-Miesian tower and the process creative destruction

(...) the problem that is usually being visualized is how capitalism administers existing structures, whereas the relevant problem is how it creates and destroys them. As long as this is not recognized, the investigator does a meaningless job. As soon as it is recognized, [the] outlook on capitalist practice and its social results changes considerably.

Joseph Schumpeter, 1943¹

Building economics and feasibility matters have a concrete influence in the architecture of tall office buildings. This type of buildings can be conceived as a form of investment in productivity – when designed mostly for owner occupancy - or as a form of financial investment – when developed mostly for rental purposes. In both instances, economic viability depends on demand of workspace in a city, availability of finance, building cost and methods to project investment returns over time. By extension, according to some economists, skyscrapers can be considered indicators of global business cycles and Cantillon effects (economic phenomena related to monetary policy). According to this interpretation, periods of boom in the production of tall buildings are indicative of epochal changes in the economy of a region – or even in the world at large. At any rate, tall office buildings respond to supply and demand of workspace in the economy of city or district; but oscillations in the supply of space in tall buildings may not be explained easily through a static model of equilibrium between supply and demand. More convincingly, skyscrapers act as a dynamic type of commodity subject to evolutionary changes over time. On the one hand, skyscrapers – since, *ipso facto* as in the case of office buildings, are often conceived as a form of business - are subject to oscillatory outputs of production that are characteristic of business cycles; on the other hand, the impulse that drives the entity of such oscillations is the availability of innovative forms of use of space, design, typology and materials and methods of construction.

¹ Joseph A. Schumpeter, “The Process of Creative Destruction,” in *Capitalism, Socialism and Democracy* (London: Allen and Unwin, 1943) 84.

8.1 The long wave

Economic indicators and skyscraper cycles in Melbourne

Cycles within a cycle

In the second half of the twentieth century, the production of tall office buildings in Melbourne completed a “long wave”, or “Kondratieff”,² type of business cycle that reached a point of crisis in the mid-1990s. Smaller waves of increasing and diminishing output occurred also within the long wave in the guise of cycles within the cycles. The supply of net lettable area during this period suggests that whenever projects with record-breaking building height were completed, the production of skyscraper in the city reached a peak and stopped or declined soon after. [See Appendix A, table A.3 and Appendix C, table C.1] The complex of AMP Square was completed in 1969, before tall office building production in 1970 came to a halt. BHP House was completed in 1972, before a low-point of tall building production that was reached in 1974. Nauru House coincided with a peak of production in 1978, and Rialto with one in 1986. In 1991, a group of large landmark tall buildings - known in the city as the “Big Six” - anticipated a drastic downturn and a decade when tall building activity stopped. Hence, it seems plausible that the total output of office building production in Melbourne aligned – in broad terms – with the time series behaviour that some economists have defined as the “Skyscraper Index”.³

These patterns suggest, however, that large (and not necessarily and only tall) office buildings were the chief drivers of supply and demand of workspace in the city. It is less apparent if the supply of work space from tall buildings is correlated, as a matter of cause and effect, with national macroeconomic conditions such as GDP and ASX Prices. [See Appendix C, tables C.6 and C.7] Hints of correlation are suggested by two moments of GDP downturn in the 1980s (in 1983 and 1990), which correspond, respectively, with the lodging of town planning applications of Rialto and of the ‘Big Six’. Looking at the time series from the mid-1950s to the late 1970s, it is harder to see plausible correlations between the Australian GDP and the city’s output of tall buildings, which, despite steady national growth, continued to start and stop according to cyclic behaviour. In two circumstances (1984-1986 and 1987-90) though, it is evident that optimism in financial

² Joseph Schumpeter, *Business cycles: a theoretical, historical, and statistical analysis of the capitalist process* (New York: McGraw-Hill, 1939): 161-173.

³ Mark Thornton, “Skyscrapers and Business Cycles,” *Journal of Austrian Economics* 8, no. 1 (2005): 51-74.

markets was anticipated by sudden growth of tall building activity in the city. Conversely, skyscraper-building cycles in Melbourne were historically accompanied by rise and fall of interest rates in Australia [Appendix C, table C.9], by an inflationary trend that grew steeply in Victoria from the mid-1970s until the mid-1990s [Appendix C, table C.8], and by growing instability in employment markets [Appendix C, table C.10].

Growing instability and evolution

Based on the data, methods and limits of investigation of this study, it can be concluded that tall office buildings in Melbourne were produced in waves within a larger wave that increased fluctuations overtime in the context of an economic background of growing instability. This macro-economic picture is confirmed by the time series of key economic indicators in Australia and in Victoria, such as interest rates, stock market prices, consumer price indexes, and unemployment rates. It cannot be excluded that quantitative extrapolations may provide further evidence to establish even statistical correlations of cause and effect between the economic background of Melbourne and the historical development of skyscrapers in the CBD. But irrelevant of such correlations, a general economic background can be identified, where the output of tall buildings in Melbourne was in line with Schumpeter's model of composite business cycle made of "many simultaneous waves",⁴ where within the long wave of forty years (1955-1995) smaller cycles overlapped, for example between 1979 and 1995, and within this intermediate wave, two to three short bursts of activity occurred. [See Appendix C, table C.1]

In synthesis, tall office buildings produced in Melbourne between 1955 and 1995 can be considered as a form of business that was subject to cyclic activity, as revealed by the increasing output oscillations of the net lettable area produced in the CBD. The time series of tall office building production in the city shows that skyscrapers were built with growing intensity and increasing levels of instability from one cycle to the next. This intensifying fluctuations were accompanied by the introduction – and by a subsequent process of evolution – of new building types, which can be considered as Schumpeterian creative destructors (new products for new markets) of preceding architectural typologies (older products for older markets). In this process of typological evolution, buildings types

⁴ Schumpeter, *Business Cycles*, 212-213.

that were able to become taller as well as larger in terms of overall net lettable area showed a superior propensity for survival.

By and large, tall office building production in the city followed three stages of development. A first period (between 1955 and the mid-1960s) saw the experimentation and genesis of new building typologies that led to the establishment of new built-form controls in the city and to the acceptance of a new concept of architectural quality shared by owners, users and designers. During a second stage (between the mid-1960s and the late 1970s), building typologies were consolidated by a process of evolution with variations on the theme, while the inner city was transformed and partially – but irreversibly - obliterated by a widespread diffusion of towers of increasing size and height. A third and final phase was reached when tall building activity intensified further - while the obliteration of pre-existing urban conditions continued - and reached output (in terms of net lettable area) that was three-fold higher than any historical annual peak of tall building activity in the city [Appendix C, table C.1].

Cultural change and destructive speculation

During the third, and last, stage, building types evolved further and tall buildings multiplied, fuelled by widespread speculative activity. A cultural change of design policy helped in part to supersede previous models of architectural design. Moreover, after three decades of technological evolution, a major peak and downturn was anticipated by a moment of “cumulative synthesis”⁵ in technological progress due to a clustering of innovations in structural, façade and building service systems. The consolidation of this sequence of innovations facilitated the work of developers and designers to produce and compete with new combinations of form and materials. This change in culture, technology and planning policy – or speaking broadly, the advent of post-modernism - was compatible and instrumental for the oversupply of space that caused skyscraper building activity in the city to hit a major peak and downturn ensued by ceased activity until the beginning of the next century.

⁵ Abbott Payson Usher, *A History of Mechanical Inventions* (New York: Dover, 1982 [1954]), 68-69.

In synthesis, the skyscrapers of Melbourne, in the second half of the last century, were the manifestation of a path of techno-economic rise and decline that was akin to Schumpeter's capitalist process of creative destruction. Within this general framework of interpretation, it is necessary to discuss the architectural modality of these transformations. As proposed in Chapter 2, a techno-economic trajectory of evolution is identifiable through a four-fold scheme of causation, which is based on interrelated enquiries about function (*causa finalis*), architectural forms (*causa formalis*), developing agents (*causa efficiens*) and material constituents (*causa materialis*) of Melbourne's tall office buildings between 1955 and 1995. This scheme of causation is linked with two starting assumptions about (1) building economics and (2) technology, which relate to a tripartite and multi-levelled interpretation of the concept of "place".⁶

In relation to these assumptions, it can be concluded that (1) Melbourne's tall office buildings were conceived according to notions of rentability, speculation and architectural quality that varied significantly in time; and (2) these buildings were conceived in a volatile techno-economic environment characterised by large-scale clustering and sequencing of technological innovations. Changes in architectural technology had broad consequences on building materials, search of architectural forms, human activities and functional purposes. This environment was not simply tied to the locale of Melbourne, but operated on an international mesoscale of place where parallel and influential events surged, from the 1930s until the 1980s, in the United States of America.

8.2 The four causes of Melbourne's skyscrapers

Flexible efficiency, private and public agents, formal resilience and material change

Causa finalis

Between 1955 and 1995, the degree of speculation of tall office buildings in the Central Business District of Melbourne changed in response to changing developer's expectations about speculative performance. Initially, tall office building activity in the city was mostly prompted by owner-occupancy and driven by corporations willing to signal prestige, improve productivity and centralise operations in the CBD. From the mid-1970s, and

⁶ John A Agnew, *Place and Politics: the Geographical Mediation of State and Society* (Boston: Allen & Unwin, 1987) quoted in Steven A. Moore, "Technology, Place and the Nonmodern Thesis," *Journal of Architectural Education* 54, no. 3 (February 2001): 130-131.

increasingly in the 1980s, tall office building production in the city shifted decidedly towards speculative purposes. In the second half of the 1980s, speculative real estate transactions and building activity were the prevalent finality of high-rise development in Melbourne.

The first generation of office blocks after World War II was, for the greater part, led by corporations willing to build new headquarters for long term owner-occupation or rental. Among these corporations insurance companies were conspicuous owner-occupiers and developers, and above all, the Australian Mutual Provident Society was the leading client and financier involved in the conception of the most notable skyscrapers of the city (e.g. AMP Square, BHP House and Collins Place). Among other corporations, banks, government and investment funds also commissioned buildings for owner occupancy; but, from the 1970s, a growing share of tall building activity shifted towards projects of speculative purpose, where several developers and superannuation funds progressively emerged as key drivers of commercial construction finalised for rental or land speculation.

This shift from owner-occupancy to a dominant level of speculation was reflected by a change of attitude towards risk that shortened the time-horizon of ownership. In the 1950s, and until the early 1970s, tall building construction was conceived as a long-term prestige-building enterprise. This attitude is confirmed by pace-setting agreements established on time frames that in some cases reached 40 or even 50 years-long periods of lease. Such were the terms agreed between MLC and Shell at Shell Corner or between AMP and BHP at BHP House. This attitude towards long-term value-building was turned upside-down in the 1980s, when short-termed forms of investment occurred more often, and when property transactions recurred often even before projects were started or completed. Such were the prevailing conditions that influenced several large “landmark” projects of the post-modern generation, including some of the “Big Six” projects of the time.

Changes in the time-horizon of the investment were accompanied by changes in the patterns of land development in the Hoddle Grid. From the late 1950s onwards, it became apparent that in order to develop tall office buildings, it was necessary to consolidate several smaller land parcels into one larger title so that limitations imposed by intricate urban patterns and fragmented real estate ownership could be overcome. Land

consolidation trends emerged in the late 1950s and intensified progressively during the 1960s, reaching the size of almost city block-wide consolidation in the 1970s, first with Collins Place, and then again with the largest skyscraper projects of the 1980s and early 1990s. Progressively, larger operations of land consolidation were finalised for the construction of larger and taller buildings on sites that could be developed for all-round access to views and free of site encumbrances. In the 1970s and 1980s, events related to some key tall office building projects of the city (e.g. Capital Tower, 222 Exhibition Street and 101 Collins Street) suggest that land speculation also acted as driver of property consolidation. These patterns of change in the use and ownership of the land overlapped with changes of urban policy, land taxation, and built-form control that were established and negotiated between planning authorities and private stakeholders.

Causa efficiens

Melbourne's profuse tall office building activity of the second half of the twentieth century was anticipated by a public debate on regulations among stakeholders that was initiated in the city in the 1920s. In 1945, the State of Victoria released the Uniform Building Regulations, a code that, on the one hand, imposed in Melbourne a prescriptive building height limit of 132 feet and that, on the other hand, left a door open for *ad hoc* modifications for single project assessments. Applications for amendment could be lodged by owners and architects and justified on several grounds, including the one to prevent interference with the course of business. This regulatory ambiguity was the terrain where a systematic approach of public-private negotiation stemmed between architects – as the voice of developer-clients – and public authorities upon the assessment of parameters of density, urban design, built-form and aesthetic character of Melbourne's skyscrapers.

In this context, public authorities did not take a passive role at the mercy of private initiatives. In fact, discussions on the opportunity to introduce a new principle of built-form controls were initiated in autonomy within the City of Melbourne as early as the mid-1950s, and in anticipation of the notorious height limit-breaking deal of ICIANZ House. Private interests and building applications certainly accelerated the process of urban transformation and eventually led authorities towards a comprehensive set of built form controls based on plot ratios. But private interests coincided significantly with public ones. The positions taken by planning authorities – via the City of Melbourne – with regard to

seminal tall building projects were a fundamental element of causation and encouragement beneath the explosion of tall building activity that began from the mid-1950s and lasted until the mid-1990s.

Public benefits arose in the form of taxation, which derived from a rating system that, by targeting as taxable the value of the net lettable area of developments, had the effect of encouraging site consolidation and maximise architectural quality and efficiency in the typical plan of multi-storey office towers. Moreover, during an initial phase, authorities saw the provision of open space by private entities as a way to decongest streets and create amenities for white collar workers in the CBD.

The City of Melbourne developed thus a systematic deal with private entrepreneurs through *ad hoc* amendments of building controls that became instrumental for the unfettered and spontaneous growth of business in the inner city. Using seminal projects to test the transformation of the CBD, local authorities set deliberately a stage for the development of a hub of prestigious business and workspace for tertiary employment in Australia. Such were the political circumstances that applied - for example – for milestone projects such as ICIANZ House, the Colonial Mutual Life Building, AMP Square, BHP House, Collins Place, Rialto and 101 Collins Street.

Once the built-form controls of the UBR were eventually overridden – officially - in the mid-1960s by plot ratio controls, the creation of tall office buildings of purist rectangular, squarish or square form went hand in hand with land consolidation and the establishment of ‘island sites’, where decongested public open space would translate into bonuses of additional floor area given to the developers. A further stage of public administration of tall building emerged in the 1970s as a result of rising awareness about environmental discomfort caused by wind to pedestrians at ground level. In the same decade, urban design inputs from the USA encouraged multifunctional block-wide transformations able to condense in one project a microcosm of office, hotel, public space and retail and these inputs reached Melbourne directly with Collins Place. In the early 1980s, another milestone of urban development in the city was set with Rialto Towers, where an explicit deal of public-private interest was exchanged – although not immune of public dispute –

through the proposal of recovery of (some) historical buildings and the creation of a catalyst of speculative regeneration on the far-western side of the Hoddle Grid.

The ground-breaking circumstances of Collins Place and Rialto anticipated a final stage of tall building policy-making in the 1980s, during which new planning decision-making – shifted to the office of the Minister of Planning of the State of Victoria, who announced the subversion of previous planning practice in the city and the implementation of new and comprehensive built form controls. The new controls aimed to influence – more than in the past - how tall buildings would relate to streetscapes and how such buildings should also look like in the skyline. More red-tape on built form, however, was counterbalanced by less prescriptive control on building approvals and by the onset of a new regulations system that contemplated – in principle and in a transitional manner - performance-based design. At any rate, the radical changes of urban and building policy of the State of Victoria during the 1980s, affected to some extent the built form of skyscrapers, albeit mostly in superficial aesthetic terms. But tightened built-form control did not hinder or mitigate in any way tall office building activity. In fact, the novel policies and design philosophies of the 1980s worked quite well as a plateau where speculative tall building activity could multiply further the output of net lettable area, thus leading to a drastic oversupply in the 1990s.

These three different moments of public participation in the making of Melbourne's skyscrapers were matched by patterns of genesis, diffusion and decline in building typology. Typological variations were the formal fulcrum that allowed skyscrapers to meet the architectural expectations of their agents (private owners and public authorities) and consolidate the acceptance of building technologies that were in an unstable state of evolution.

Causa formalis

Tall office building typology in Melbourne evolved gradually as a process of experimentation, which in many cases anticipated the definition of city-wide controls promulgated by planning authorities. The first experiments started in the 1950s on the eastern fringe of the Central Business District and moved within the Hoddle Grid in the

1960s, where new pace-setting projects clustered first at the intersection of Queen and Bourke Streets and then further west at the intersection of William and Bourke Streets.

In broad terms, between 1955 and 1995, the typologies that were dominant in Melbourne were two. The first was the side core slab, which was embodied by seminal projects such as ICIANZ House and the Colonial Mutual Life Building, and then developed as an internal column-free version at HC Sleigh Corner, Eagle House and Commonwealth Bank House. The second dominant typology was a tower squarish or perfectly square in plan. In Melbourne, this model started in embryonic form in the early 1960s and evolved as a purist 'monolithic' model (free-standing square plan tower with four-sided column-free space and centre core), which was enriched by subtle variations on the theme from the late 1960s until the late 1970s. The type continued to be the formal basis – albeit with some mutations and disguising features – of the towers of key tall building landmarks completed in the city during the 1980s and in the early 1990s.

At the time of the genesis, the two typologies responded to a new concept of architectural quality that sought long-term value for owner occupiers as well rentability through open space (preferably column-free), access to views and daylight, flexibility of subdivision into multiple tenancies, modular control and the neat separation in plan of services and rentable space. Progressively, from the 1970s onwards, the option to give interior designers as many corner rooms as possible per floor was added to the repertory of desirable architectural qualities, thus eroding the monolithic look of purist plan shapes of the earliest models of the 1950s and 1960s.

In Melbourne, the square plan tower prevailed, in the course of time, as the more resilient of the two typologies for being able to adapt, with more ease than the slab, to different site conditions, building heights, aesthetic trends and technological changes. The formal evolution of square plan towers in Melbourne is an example of resiliency that responded also to changes of built-form control in Melbourne's CBD. Square plan towers were a successful instrument of implementation of the development principle on a site-density basis, or plot ratio, which the city embraced as the chief criteria of tall building approval from the late 1950s until the 1990s. The square plan tower, particularly in the free standing version surrounded by public open space, was a materialised expression of the

diagrammatic explanation of plot ratio controls. Likewise, once more elaborate formal controls were implemented in the 1980s, the type survived the test of post-modern times. The square plan tower, with minimal cosmetic adjustments that enhanced corner-office opportunities, signalled diversity without flat tops and thus fitted well with a speculative economic environment that preferred marketing diversification. Moreover, the typological skeleton of the square tower could be easily shifted over medium rise podiums to mitigate environmental wind problems at street level. At the same time, the square tower on podium satisfied planning authorities, which were engaged in the task of reinstating the older city façades and streetscapes and therefore opposed blank walls and setbacks at street level, seen as a taboo in CBD urban design.

The causes behind the formal resiliency of the square plan tower can be summarised according to the three principal objects of architectural typology listed in Chapter 2: site location, plan shape and distribution of the parts.

Square plan towers were able to provide all-round access to views while they maintained the ability to optimise use of the land, shape of the typical plan and orientation in relation to main streets. In Melbourne, the site orientation of square towers could reinforce the orthogonality of the street patterns or, when needed, it could be set independently of the grid. While the first examples of square plan towers in Melbourne (e.g. ACI House, AMP Square and BHP House) reinforced visually the orthogonality of the Hoddle Grid, several projects of the 1970s and 1980s (Collins Place, State Bank Centre, Nauru House, Rialto, Melbourne Central) were able to keep the formal arrangement of the square on square, but rotated by 45 degrees from the main streets. In this way orientation was set diagonally against prevailing winds, thus minimising the environmental impact of winds for pedestrians on footpaths and public open space.

The second stronghold of this typological fortune derived from the shape of the typical plan. The square plan was not the formal minimum of envelope length in relation to floor area – only a circular plan would provide maximum efficiency in that sense. But the square plan was somewhat the sensible optimum of envelope length for maximum area that was able to provide long-term expectations of flexibility (for owner-occupied purposes) and/or safe rentability outcomes in the short term (for speculative purposes).

Moreover, the square plan type had the ability to grow larger and generate taller towers in time, while the benefits derived by its distribution of the parts remained fundamentally unaltered. As building height grew in time, so did tower footprints and core layouts in order to accommodate larger numbers of lift banks. The type in Melbourne started on an embryonic footprint of 80 feet size (Feltex House), then of 90 feet (ACI House and State Government Offices) and then consolidated to approximately 120-130 feet (AMP Square, BHP House, Nauru House and Capital Tower). In the 1980s, the square plan tower was fine-tuned according to metric modularity shifting the consensus among designers and developers on footprints of minimum 40 metre side and able to accommodate up to four lift groups in the central core.

As Melbourne towers became taller and larger in plan – also as a result of larger operations of property consolidation in the CBD – the cost impact of the building envelope diminished in relation to other factors of cost control. So, as floor plates became larger, façades could justify more elaborate designs, since the wall/floor area ratio remained fundamentally unchanged, if not less relevant. This design stratagem, described in America as the cost-quality paradox, allowed the building envelope to be free from the purist geometric constraints of cost control, and produce façades with a richer vocabulary of materials, re-entrants, corner cut-offs and stepping set-backs. With different combinations for different projects, these variations gave appeal of singularity for anchor tenants, in times (the 1980s) where tall office buildings were conceived mostly for speculative purposes in a highly competitive market.

While the perimeter of the building became, in the course of time, progressively disengaged from the monolithic purist theme of the square on square, the neat distribution of the parts could continue unaltered with the centralisation of services, column-free deep space, access to views on four sides, ability to subdivide floor plans in multiple tenancies and uncompromised internal circulation. The square tower also offered ability to resist lateral loads more efficiently by concentrating (and whenever possible by rarefying) structural elements along the perimeter of the building and in the core. These spatial qualities were quantitatively defined by the core to façade distance – or leasing depth – of the typical floors, that in the course of time settled in a typical span of 10 to 11 metres.

Moreover, the square plan tower was a paradigm of integrated architectural quality and technology, where the dicta of rentability, optimal use of the land and built-form control of planning authorities could coexist successfully. The square tower was also a typological model open to the testing of new building materials, systems, services and construction methods through a protracted sequence of development and change across four decades of technological evolution.

Causa materialis

After WWII, tall office buildings in Melbourne developed new spatial models in the context of a volatile state of technological evolution. These changes were induced by strategic innovations that affected building materials, methods of construction and active systems of environmental control. The territory of change was not limited geographically within the boundaries of the Victorian or Australian building industry. Change was shared with, and in large part imported from, a broader international context, which was likewise in rapid evolution, and which had the epicentre in the United States of America. The strategic importance of these changes is testified by progresses made in different sectors of the construction industry both in both countries. Progress occurred with a significant parallel and technological transfer (chiefly from America to Australia) that happened for the greater part between the 1950s and the 1970s. Technological change and transfer affected four basic materials that are essential for commercial architecture: steel, concrete, aluminium and glass.

In this technological milieu in evolution, steel construction, after WWII, was interested by new methods of fabrication and assembly (arc welding, high-strength bolting and stud welding) that facilitated the diffusion of rigid frames and proved to be essential for dry and/or light-weight tall building structures. Concrete technology, in the same period, developed new methods of delivery based on mechanization and prefabrication, which had strategic consequences for the cost-efficient construction of service cores, large-span floors and precast building envelopes. After WWII, aluminium manufacturing and fabrication technologies were borrowed from the aeronautical industry and introduced, practically *ex-novo*, in the American and Australian construction industries. Considered at first as a potential substitute of steel for primary structural applications, aluminium soon proved to have far-reaching consequences in claddings and as the ideal complement of glass in light-

weight façade systems due to excellent workability and ability to meet custom-designed demands. Glass-making and products also underwent significant transformation between the 1950s and the 1970s, as the material transitioned – in relation to tall office building applications – from single-panel heat-absorbing plate glass to double-glazed reflective-coated float glass.

To the technological changes of these four materials, it is necessary to note progress in the artificial control of a fifth element, air, which was – alongside important progress made in other building services, such as lifts and lighting – responsible for some of the most radical repercussions on tall office building design. From the 1950s until the 1970s, air conditioning applications in tall office buildings underwent rapid and radical transformations, transitioning from low-velocity constant-air-volume systems to the more space-efficient and centralised high-velocity dual-duct systems combined with peripheral induction units; finally air conditioning systems reached the milestone of more energy-efficient and ceiling-distributed variable-air-volume systems during the 1970s.

In this milieu of technological progress, Melbourne's tall office buildings were a test-bench for the experimentation and/or consolidation of new systems as these became progressively available in the Australian building industry and in many instances as a direct transfer from America.

A local trajectory of technological evolution can be traced in the approach followed by Melbourne's construction industry on tall structural systems. At first, tall office buildings were the terrain of experimentation with all-steel frames complemented by dry methods of assembly on site, such as gypsum plaster or precast concrete panels. Reliance on in-situ – or wet - concrete, however, grew historically in the city as a technological element of local distinction for high rise. Concrete technology in Melbourne's skyscrapers transitioned from the complementary role of steel for fire-proofing, to that of primary structural associate in hybrid and composite systems. Concrete then surged as an autonomous alternative to steel for integral all-concrete structural solutions; wet concrete methodologies developed in the second half of the 1970s and flourished as the dominant solution in office buildings of the CBD in the 1980s and 1990s.

Notwithstanding the broad knowledge-transfer in construction technology that spread from North America to Australia, in some respects Melbourne, and by plausible extension other Australian cities, developed a concrete-dominant approach to tall building construction. The local approach combined also European inputs (for instance through Swiss post-tensioning patents), and it was encouraged by a rapid *in-situ* method of mechanized vertical construction (e.g. jump-forming) that was invented and further developed locally from the mid-1970s onwards. In this concrete-dominant environment steel and dry construction methods maintained their presence on building sites, but became structurally secondary as the complement of in-situ concrete, which was preferable for mass-driven wind resistance in the tall structures of a city subject to negligible seismic activity.

8.3 The Post-Miesian tower techno-economically considered

Austerity, simplicity and all-round efficiency in times of uncertainty

Global and capitalist: hence anti-vernacular

It is not an oversimplification to define many of the skyscrapers conceived from the 1950s until the 1990s as buildings that were wholly – and not only stylistically – “international” and somehow “interchangeable” from one site to another and from one city to another.⁷ These buildings had to respond to a broader concept than those normally denoted by words like ‘environment’, ‘site’ and ‘surroundings’. From the 1950s onwards, designers were increasingly confronted by a multi-levelled conception of place, where international influences of technology and architectural design were in constant progress or subject to sudden transformations. In these conditions, it could not suffice for developers, architects, engineers and planners to respond with localism, regionalism or a vernacular approach to tall building design. In this sense the ‘monoliths’ of the 1960s and 1970s were a broader ‘environmental’ architectural response, which could not be satisfied by a stylistic response to inputs given by specific sites and surroundings. If reduced to a smaller and less international geographical environment, this evolutionary pattern in architecture becomes

⁷ Carol Willis, *Form Follows Finance: Skyscrapers and Skylines in New York and Chicago* (New York: Princeton Architectural Press, 1995), 7.

not dissimilar from one that was identified for the stylistic changes of the skyscrapers in Chicago from the late 1800s to the early 1900s.⁸

The international skyscraper was not necessarily immune and insensitive from influences of place-making; it was implemented according to a broader notion of place, a multi-levelled milieu where the use of versatile typologies was the less risky answer to provide space-quality, rentability and long-term flexibility. Simplicity of form was the resilient response to an environmental condition that was governed by technologies available far beyond the ones provided by a local, subjective and micro-geographic sense of place.

Purist genesis and long-term intent

The skyscrapers of Melbourne developed in response to the concomitant interaction of four causes inclusive of (1) speculative and operative economic purpose, (2) private and public agency, (3) formal and (4) material inputs inspired by a quest for all-round efficiency in design and construction.

Between 1955 and 1995 the motives behind building skyscrapers in the city could not be ascribed unilaterally to an ethos of optimised profit-maximising.⁹ While the formal outcomes of some landmarks in Melbourne's skyline may seem a crude aesthetic declination of modern architecture, it remains that tall building activity stemmed at first from needs of owner-occupancy that sought long-term value-making, quality of workspace and corporate prestige. This long-term inspired genesis went alongside reasonable and inevitable private expectations of rentability, and it was also directed and steered through four decades of private-public deals in tall building control and approval.

Notwithstanding the economic imperatives of buildings made for business and/or as business, several tall building landmarks were deliberate attempts to create long-lasting corporate prestige through simplicity of form. That these buildings were conceived as "corporate totems" in a global economic network, rather than a "cliché",¹⁰ in Melbourne was indeed, in several instances, a factual reality, particularly in the 1950s, 1960s and early

⁸ Thomas Leslie, "Glass and Light: the Influence of Interior Illumination on the Chicago School," *Journal of Architectural Education* 58, no. 1 (September 2004): 13-23.

⁹ Leonie Sandercock, "Melbourne: Capitalism, Crude and Uncivilized," in *Cities for Sale* (Melbourne: Melbourne University Press, 1975), 145-175.

¹⁰ Willis, *Form Follows Finance*, 153.

1970s. But symbolic goals of prestige did not preclude designers from considering above all spatial quality, flexibility and efficiency in operation. With this in mind, the economic imperatives of modern tall buildings participated in economics in a far more articulated way than a formula that tied simplicity of form with profit-making may suggest.

The Post-Miesian reconciliation

Once the techno-economic context of Melbourne's skyscrapers is elucidated, it becomes difficult to deprive a large family of commercial buildings of architectural significance on the basis of formal outcomes alone. Born and developed in times of economic challenge first (the post-war boom) and austerity after (the energy crisis), skyscrapers – including the ubiquitous and anonymous squarish or square towers of the 1960s and 1970s - developed in an environment where targets of all-round efficiency were paramount.

This industry-wide call for efficiency, in America as well in Australia, was not limited to matters of rental return, but extended to matters of ongoing efficiency in operation – including energy use - and openness and adaptability for technological innovation in construction. Much emphasis was given, at least since the 1950s by owners and designers of tall buildings for what at the times were the state-of-the-art innovations in technology and spatial design. It would be an instrumental oversimplification to relegate *a priori* the ubiquitous post-Miesian towers as a design-product where minimising area of envelope in relation to floor meant only maximised short-term money-making. Formal simplicity would also be grossly mistaken if taken only as numeric efficiency or ascribed to ignorance of long-term running costs. The longitudinal picture described by this study suggests that many anonymous buildings of the 1960s and 1970s may deserve a different critical fortune.

Building a critique on a multi-disciplinary array of concerns, the so-called “post-Miesian tower”, rather than a disdainful anachronism of energetic short-sightedness,¹¹ may have been very well the last attempt to reconcile and “heal” the dichotomy between architecture and engineering denounced by Sigfried Giedion.¹² At closer inspection, the will to

¹¹ Peter Buchanan, “The Tower: an Anachronism Awaiting Rebirth,” *Harvard Design Magazine* 26 (2007): 1-5.

¹² Sigfried Giedion, “Mies and the Integrity of Form,” in *Space, Time and Architecture* (Cambridge, MA: Harvard University Press, 1967), 607.

reconcile technology and aesthetics may have endured also after Mies, in line with the Chicago School, and taking several steps forward beyond the experimental paradigm of the 'crystal' slabs of the 1950s. Reconciliation was sought through unity of intent between different project parties and through the purist integration of form and function into an oversimplified, but globally versatile, efficient and flexible tall building typology.

The subsequent cultural damnation of the "monoliths",¹³ which flourished in response to the destructive character of these tall buildings, may have disallowed an examination without formal prejudice of one of the last moment of the twentieth century, when architecture and engineering were in concord for the integration of technology and aesthetics, form and materials, and when both disciplines were propelled by a shared intent to provide universal and long-lasting space quality through commercial architecture.

A response to the environmental nightmare

The anti-technocratic fears of the "well-tempered nightmare",¹⁴ which were invoked particularly after the Oil Crisis, may have, perhaps unwillingly, induced future generations of architects to liquidate as irresponsible the stylistic austerity of those years, confusing causes for effects and thereafter distorting the message left by a generation of buildings, where spatial and technological efficiency were paramount.

After the 1970s, taking advantage of the cost-quality paradox of building envelopes in ever-growing footprints, it became possible to disguise cosmetically the austere appearance of the previous generations of skyscrapers behind flamboyant facades, volumetric indentations and non-flat tops. At the same time, the new skin-deep vocabulary fulfilled the role of attracting speculative market interest during techno-economic conditions that were more forgiving than in the past, and yet subject to more extreme cyclical variations. In Melbourne, from the mid-1970s onwards, the transition to the postmodern age was matched by larger operations of inner-city destruction and a trend to shorten the time horizon of tall developments that favoured risk-taking through speculative endeavours rather than the long-term owner-built investments of many earlier examples.

¹³ John Keynon, "Damned Monoliths: an Architectural Critique of Highrise," in *The Ultimate Highrise: San Francisco's Mad Rush Toward the Sky*, edited by Bruce B. Bruggmann and Greggar Sletteland (San Francisco: Bay Guardian, 1971), 177-187.

¹⁴ Reyner Banham, "The Well-Tempered Nightmare," *Australian Refrigeration, Heating and Air Conditioning* 23, no. 3 (March 1972): 43-46.

In this light, the stance that in the 1970s tall building architecture may have reached a point of “terminal mediocrity”,¹⁵ where “innovation withered” shifting to second place behind real estate formulas,¹⁶ could only emerge from superficial stylistic observations. Formal austerity was a point of arrival that matured from the 1950s in response to unstable technological conditions. Strategic innovation did not stop soon after the World War II with the glass slabs, but it was prolonged and reinvigorated by a global energy crisis in times of rising inflation and economic uncertainty.

The Schumpeterian *terminus* of post-modern aesthetics

Judging from this case study on Melbourne and extrapolating in virtue of the parallels of this city with a broader Australian-American context, if there was ever a *terminus* in the architectural evolution of tall office buildings, it seems more plausible to set a point of no return in the mega-buildings of the post-modern age, which in the Australian city materialised in particular during the late 1980s and early 1990s. In Melbourne, this third stage was also final and self-destructive, and it was the effect of a speculative excess that could hardly be reconciled in quantitative terms of supply and demand of office space. This stage was the last step of a Kondratieff business cycle that started in the 1950s and that, following a process of creative destruction, obliterated the fine-grained fabric of the central city by substituting – without much regard for historic heritage – older building types with new ones of perceived superior architectural quality and techno-economic efficiency.

The process of creative destruction followed a continuous trajectory that did not stop in the 1980s, but was actually intensified in that decade and went on in synchrony with the emergence of post-modern inspired city planning. So, while the slabs and square monoliths of the 1960s and 1970s took much of the blame for the destruction of the Marvellous Melbourne of the 1800s and early 1900s, some less denounced - but equally regrettable - acts of authority-endorsed creative destruction took place or were envisaged in 1990s at the expense of buildings (e.g. Hume House, Shell Corner and ACI House) guilty of being too

¹⁵ Ada Louise Huxtable, *The Tall Building Artistically Reconsidered: the Search for a Skyscraper Style* (Berkeley – Los Angeles: University of California Press, 1982), 52.

¹⁶ James S. Russell, “Form Follows Fad: the Troubled Love Affair of Architectural Style and Management Ideal,” in *On the Job: Design and the American Office* edited by Donald Albrecht and Chrysanthé B. Broikos (New York: Princeton Architectural Press, 2000), 65.

small to be competitive in a speculative-centred market changed by new aesthetic dicta promulgated by post-modern urban designers.

The typological evolution of Melbourne's skyscrapers testifies that an evolutionary thread bridged – rather than divided - modernism to postmodernism in the design of commercial architecture. Subtle variations on the theme were set within the typological invariance of the square plan tower, which was the key element of architectural consistency and continuity from the 1950s until the 1990s. Along this process, the skyscrapers of the 1960s and 1970s surged as the answer - as a global typology - to the rise of a global economic environment, where design choices on building materials and energy consumption had to be taken by necessity beyond localism.

Conclusion

There are two strategic influences that were significant for the production of tall office buildings in Melbourne during the second half of the twentieth century.

The first influence was due to a local approach to urban design caused by commercial initiatives about the use of the land in the CBD promoted by private and public stakeholders. Tall office building production was mediated by a culture of design informed by a quest for all-round efficiency. Efficiency was determined and defined by space quality requirements, concerns for work productivity and control of costs in operation. Following increasing speculative activity, concerns of spatial quality shifted from all-round design aspirations of integration of architecture and engineering towards concerns of marketing differentiation that were transmissible, above all, by the building envelope. In parallel with these instances, the business purpose of economic feasibility was allowed by a deal of ongoing negotiations between private developers and public authorities. Regulatory obstacles found on single projects were resolved on *ad hoc* basis in Melbourne, and solutions developed for landmark tall building projects were adopted as methods of general built form control for the inner city. Historically, planning authorities used tall buildings in Melbourne to provide what were perceived as primary public benefits in the form of open space, taxation from net lettable area and, at a later and final stage, the entitlement to express voice in the aesthetic outcome of landmark projects.

The second influence stemmed from a culture of risk mitigation in economic development and construction technology that concerned in particular building envelopes, services and structural construction methods. In the context of sequential steps of innovation and obsolescence – not immune by failures and lessons learnt – and due to evolving building technologies imported in prevalence from the United States of America, a building type, the square plan tower, rose as the dominant skyscraper typology in Melbourne in the 1960s and 1970s. Attempting to reduce the ratio of wall to floor area with a purist plan shape, the square plan tower was emblematic of an international phenomenon of austerity in commercial architecture that had to confront a

period of energetic, economic, and technological uncertainty that originated after World War II and faded only in the 1980s.

A formal disengagement from purity thus emerged in the envelope of tall buildings in correspondence with the cultural affirmation of postmodernism. This cosmetic shift was the final stage of a Schumpeterian long wave cycle of building activity that coincided with a major moment of crisis induced by these techno-economic circumstances:

- New design opportunities were offered by a cost quality paradox that allowed aesthetic refinements of the building envelopes to translate in image-driven value; these aesthetic requirements were made possible by buildings that, because bigger and larger, became less reliant on the necessity to minimise cost by reducing the bill of quantity of façades; in Melbourne, postmodernism decreed the stylistic end of monolithic aesthetics and promoted design trends that started to erode the building envelope, albeit following inside, by and large, the internal distribution of the square plan tower type.
- A cumulative synthesis of technological advancements was reached in the 1980s; designers were able to make recourse to a broad range of structural typologies (tubular, belt trusses, tube in tube) and different approaches in the use of primary materials (steel, concrete or a combination of both); moreover, progress in wind engineering knowledge, revealed that pure rectangular shapes were among the most aerodynamically adverse; advancements in air conditioning reached the milestone of ceiling-concealed energy-efficiency with variable air volume systems in the 1970s; and finally, in the same decade advancements in facade construction systems matured and set the stage for a progressive disengagement from precast concrete facades; these advancements allowed designers to recuperate the aesthetic language of the ‘crystal towers’ of the 1950s, due to progress made with pressure equalisation, reflective glass and unitised curtain wall systems.

The evolutionary pattern that affected tall building architecture in Melbourne indicates that, despite apparent formal invariance and superficial similarities, many built examples of the 1950s, 1960s and 1970s stemmed from a development culture that

sought long-term value, and that the buildings of the period were a nexus with global technological and economic forces that were in a state of progressive evolution and instability.

While being generated in the context of *ad hoc* public-private deals and enterprises, tall building developments relied upon ongoing specialist technological inputs, whilst building technologies imported from overseas changed at a considerable pace and reached a strategic point of arrival in the late 1970s. In final synthesis, based on evidence of entrepreneurial activity that developed cyclically and along a long wave of technological change, the pattern of genesis, expansion and oversupply of tall office buildings in Melbourne in the second half of the twentieth century demonstrates that skyscrapers are sector of the built environment that develops along dynamics that are chiefly techno-economical and that conform to the capitalist process of creative destruction.

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