COX Submission to State Significant Development Application

Sydney International Convention, Exhibition and Entertainment Precinct Darling Harbour

10 May 2013

Submission by:
Cox Richardson Architects & Planners
Level 2, 204 Clarence Street
Sydney NSW 2000, Australia

10 May 2013

Note, Cox has been involved in the design of the following convention and exhibition facilities;

- Brisbane Convention & Exhibition Centre
- Brisbane Convention & Exhibition Centre Expansion
- Cairns Convention Centre
- Canberra National Convention Centre
- International Convention Centre, Durban
- International Convention & Exhibition Centre Arena Expansion
- Hyderabad Exhibition and Convention Centre
- Indonesian International Expo (under construction)
- Kaohsiung Exhibition & Convention Centre (under construction)
- Kuala Lumpur Convention Centre
- Mackay Convention Centre
- Melbourne Convention & Exhibition Centre reference design
- Perth Convention & Exhibition Centre
- Singapore Expo
- Sydney Exhibition Centre
- Sydney International Convention & Exhibition Centre feasibility

Contents

Executive Summary

Cox Richardson objects to the proposal to demolish and redevelop Daring Harbour. Outlined below is a summary of our submission and objections.

COX was the architect for the Sydney Exhibition Centre, the Australian National Maritime Museum and the Sydney Aquarium and clearly declares an interest in the future of Darling Harbour in general and the COX designed buildings in particular.

Objection 1

No proper Heritage Impact Assessment of Late 20th Century Darling Harbour has been undertaken as required by the Director General and the Heritage Council.

Objection 2

No proper Heritage Impact Assessment of the Sydney Exhibition Centre has been undertaken as requested by the Heritage Council.

Objection 3

No recognition has been provided of the Heritage Listings of the National Trust of Australia (NSW) and the Australian Institute of Architects.

Objection 4

The project should not proceed without a proper assessment of the importance of the people, the places, buildings and art works that are Darling Harbour.

Objection 5

No evidence based justification for the demolition of Darling Harbour has been submitted. Every report has recommended expansion, not demolition.

Objection 6

The Sydney Exhibition Centre, Tumbalong Park and the Urban Stream can be saved and should be saved.

Objection 7

The economic benefit of the new development declines from $400 million to $200 million per annum.

Objection 8

The construction cost may not deliver appropriate quality for Darling Harbour.

Objection 9

No cost per annum to NSW has been identified.

Objection 10

Financial risks to NSW have not been identified.

Objection 11

An alternative master plan would enable continuous operation of Darling Harbour. Darling Harbour does not have to go dark.

Objection 12

Darling Harbour loses 8,000 sqm of column free exhibition space.

Objection 13

Darling Harbour loses 12,000 sqm of column free space in one room.

Objection 14

Darling Harbour loses 3,000 entertainment seats

Objection 15

Darling Harbour gains little more capacity over what exists today. The proposal does not seem to deliver the area required by the government brief.

Objection 16

Darling Harbour entertainment and conferencing proposal is no more integrated than today.

Objection 17

Darling Harbour Entertainment is no longer a sports venue.

Objection 18

No expansion capacity is identified in the proposal.

Objection 19

The scale of the proposed buildings on Tumbalong Park will dominate the park. They are well above the existing Exhibition Centre mast heights.

Objection 20

The scale of the buildings blocks the existing views of the City from William and Quarry Streets.

Objection 21

The public concourse to the new exhibition building is some 9 metres above Tumbalong Park and the new event deck is some 19 metres above Tumbalong Park without satisfactory public connection.

Objection 22

The scale of the new convention centre is twice as high as the existing Convention Centre on Sydney Harbour.

Objection 23

It is not sustainable to remove the existing purpose designed buildings and mature landscape from Darling Harbour.

Objection 24

The usable public space is reduced by 14,000m^2

Objection 25

No master plan options have been exhibited for Darling Harbour.

Objection 26

The proposal offers reduced public benefits to NSW.

1.0 Heritage

1.1 Heritage Impact Assessment compliance with Director General Requirements

" Heritage

- *Address the impacts of the proposal on heritage significance of the site and the adjacent area including any built and landscape heritage items including places, items or relics of significance to Aboriginal people; and*
- *Address opportunities for heritage interpretation within the public domain."*

By ignoring all National Trust and Australian Institute of Architects listings and ignoring any nominations to the Heritage Council and submitting a very short Bicentenary history the consultants have taken a very narrow view of these requirements.

Further when one examines the Heritage Council letter to the Department of Planning and Infrastructure of the 21/12/2012 it states;

"..it is considered that the following should be included in the amended Director General's Assessment Requirements.

1. ***The Applicant must undertake a highly detailed archaeological assessment which includes a consideration of Aboriginal, non-Aboriginal and Maritime heritage. This archaeological assessment should consider the proposal below ground impacts on any potential archaeology and in addition, consider what archaeological works have already been undertaken on this site which may provide information to aid in this assessment. The assessment should include overlay maps and assessments of significance for the potential archaeological resource utilising appropriate Heritage Council Guidelines such as "Assessing the Significance of Archaeological Sites and Relics". It should also contain mitigation strategies to manage this potential archaeological resource which may include redesign to avoid significant archaeological testing or salvage during project works.***
2. ***A detailed Heritage Impact Assessment should be undertaken which documents and assesses the heritage significance of the site and its associated landscape and any impacts the development may have on this significance. This assessment should specifically include an assessment of the landscape features of the precinct and the current Exhibition Centre. It should also include a consideration of wider heritage impacts in the area surrounding the site. This assessment should also include detailed mitigation measures to offset the impacts this project may have on the precincts heritage values.***
3. ***The Heritage Impact Statement should also have regard to any impacts on places, items or relics of significance to Aboriginal people. Where it is likely that the project will impact on Aboriginal heritage, adequate community consultation should take place regarding the assessment of significance, likely impacts and management/mitigation measures.***
4. ***The Applicant must ensure that an outline of the on-site heritage interpretation plan is undertaken as part of the EIS.***
5. ***The interpretation should include all aspects of the sites history and heritage and the Plan should identify avenues for appropriate and innovative public understanding and appreciation of this heritage as part of the completed development."***

Given that both these documents were available to the applicant it should be reasonable to expect the DGRs would be considered an abbreviated version of the Heritage Council considered view. Clearly the Heritage Council expect a broad assessment of the heritage of the place.

This is a critical issue for this application and as a precedent for the future.

The Heritage Impact Assessment ignores the late 20th Century history of Darling Harbour.

A proper Heritage Impact Assessment should be undertaken.

1.2 Heritage assessment of Darling Harbour

Good practise would address assessment and listings beyond the narrow frame of current State Heritage Listings. Indeed the DGR's require the assessment to include the State listed items, not exclusively focus on those items. The Heritage Council is clearly seeking a broader assessment of the significance of the place.

The Bicentenary celebrations at Darling Harbour constitute a significant celebration in Australia's history. Darling Harbour was specifically created as a "place for people", retained in public ownership for the people of NSW.

Darling Harbour includes the work of a number of significant architects and firms of architects;

- John Andrews, AO, AIA Gold Medal, perhaps Australia's first and only international architect,
- Edwards, Madigan, AO, AIA Gold Medal, Torzillo and Briggs, the architects for Australia's National Gallery and High Court buildings,
- McConnell Smith and Johnson, led at the time by Professor Peter Johnson, AC, AIA Gold Medal,
- Ken Woolley, AM, AIA Gold Medal, leading Sydney architect,
- Robert Woodward, AM, architect for the El Alamein Fountain, and;
- Philip Cox, AO, AIA Gold Medal

Their works at Darling Harbour have been recognized by the AIA and the National Trust, yet no reference is made to this in the Heritage Impact Statement. These are significant figures in the history of Australian architecture. Darling Harbour presents a unique assembly of their works. They demand proper assessment and respect.

The buildings also exhibit the work of the internationally renowned engineers Ove Arup.

The landscape of Darling Harbour, Tumbalong Park, the Urban Stream and associated linkages are a fine example of late 20th Century landscape architecture in Australia. They demand proper assessment.

The Convention Centre holds a significant collection of Australian paintings. These should be retained in place.

Attached is an excellent Discussion Paper by Andrew Andersons AO on the history and significance of Darling Harbour as created for Australia's Bicentenary. Andrew Andersons was involved in the design review process for Darling Harbour. He is also an important figure in the history of Australian architecture. This demands careful assessment and respect.

The late Neville Quarry, AIA Gold Medal, another important architect and educator was also part of the design review process at Darling Harbour.

The project should not proceed without a proper assessment of the importance of these all these people, places, buildings and works to Australia.

These places and buildings can be saved and should be saved.

Cities are not inert objects that can be dissected at will - they are the repositories of history of the ideals and aspirations of people who built them and the inheritance of those who follow.

The great cities of the world are enriched by the fruits of layers of history - Sydney can be a great city, but it will not be if it continues to be robbed of the building that tell its stories. The inner city cultural precinct of Darling Harbour was born of a time for Sydney of economic buoyancy and optimism and the major public buildings of the Exhibition Building and the Convention Centre are representational of that time and a part of the weave in the both the fabric and the story of the city. Public buildings speak for the collective, and the loss for the city of th unjustified proposed demolition of two of Sydney's most significant public buildings of the end of twentieth century, must be realised and such a short-sighted and irresponsible act prevented.

Professor Jennifer Taylor

1.3 The Sydney Exhibition Centre

1.3.1 Historical and Cultural Significance

The Sydney Exhibition Centre was the first major exhibition centre to be built in Sydney since the Garden Palace. The Garden Palace was built in 1879 in the Royal Botanical Gardens to commemorate Australia's Centenary. It was destroyed by fire less than three years after completion, leaving Sydney without an international standard exhibition facility for over a century.

It was also one of the key developments in establishing the redeveloped Darling Harbour Precinct in Sydney and anchoring Darling Harbour South.

The Centre was constructed to celebrate Australia's 1988 Bicentenary. Key events were hosted in the Centre including an official State Bicentenary Dinner and the Bicentenary Exhibition.

Since then the Centre has been used as the NSW principal venue for international events and conferences. A highlight being the venue's prime role for the Sydney 2000 Olympic Games, bringing the Games to the CBD. It was the venue for boxing, wrestling, weightlifting, fencing and judo with a total seating capacity for over 30,000 spectators.

1.3.2 Technological Significance

The structural system for the Centre established new benchmarks in long span building design. Apart from its structural applicability, the mast and rod formation is intended to have an abstract nautical metaphor, thematically continued in its outriggers, bridges and panelled steel cladding.

A highly efficient structure, the building was erected in a short period of time. The integrated roof structure and cladding system allowed for easy and safe erection with minimal scaffolding.

In designing the facility, new standards were also established for fire engineering and fire safety. Research into crowd behaviour and fire loads helped established rational and economic approaches that have benefited many projects since and led to the alternative solution principles of the current codes.

This has been recognised internationally with the Centre being selected as a Finalist in the 1988 World Quaternario Awards and various national and state engineering awards such as the Commendation Building and Civil Design, National Engineering Excellence Awards 1988.

1.3.3 Architectural Significance

The Centre has been recognised nationally and internationally as being of considerable merit. It has been covered by journals around the world.

It has been recognised by the Australia Institute of Architects for its excellence. In 1989, it was awarded the Sir John Sulman Medal RAIA (NSW Chapter) by a committee chaired by Harry Seidler. In the same year it was a finalist for the Sir Zelman Cowan Award.

Internationally it is mentioned in Bannister Fletcher, the authoritative book on world architecture, as an important contribution to World and Australian Architecture.

It is also mentioned as an example by excellence by Scharpe as an outstanding example of Twentieth Century Architecture.

In 2010, the Centre took out the title of Australasia's Leading Meetings and Conference Centres in the World Travel Awards for the fifth consecutive year.

Thousands of industry travel professionals voted in the awards with the venue winning over a number of other regional venues.

The Centre continues to win awards for venue excellence and, in 2012, the Centre won Best Venue in the Australian Event Awards.

1.3.4 Heritage Listings

The Sydney Exhibition Centre has been listed as an item of heritage by the Australian Institute of Architects and the National Trust.

It is listed by the AIA under the NSW Significant 20th Century Architecture category, item number 4700327 on the NSW Institute Register.

In the National Trust's Statement of Significance in its Listing Report, it is noted that the "Sydney Exhibition Centre is an exemplar of collaboration between architect and engineer" and "is acknowledged as an aesthetically distinctive design" and "established new benchmarks in building design for the construction industry".

A nomination to the State's Heritage Register is currently being considered by the NSW Heritage Council.

1.3.5 Design Awards

1989 Sir John Sulman Medal – RAIA (NSW Chapter)

1989 Sir Zelman Cowan Award Finalist – RAIA

1988 Commendation Building and Civil Design – National Engineering Awards

1988 ACEA Special Merit Award

1988 Finalist World Quaterario Awards

1987 IE Australia Sydney Division Winner – Building and Civil Design (Roof Structure)

1987 IE Australia – Highly Commended – Building and Civil Design (Roof Structure)

1.3.6 Industry Awards

2012 Australian Event Awards: Best Venue

2003 – 11 World Travel Awards - Australasia's Leading Meeting and Conference Centre

2008 – 11 Events Industry Association of Australasia – Best Green Initiative Award

2011 Green Globe Silver Certification

2011 EarthCheck – Silver Certification

2010 Meetings and Events Australia National Awards – Best Meeting Venue for 500+ delegates

2009 Green Globe Silver Certification

2001 World Travel Awards - Australasia's Leading Meeting and Conference Centre

Summary

We submit that the information outlined above demands a full heritage impact assessment of the Sydney Exhibition Centre.

This position is supported by DOCOMOMO, ICOMOS, The National Trust of Australia and the Australian Institute of Architects

Exhibition Centre Masterpiece

- *Of all of the buildings in Darling Harbour, the most outstanding is the Exhibition Centre.*
- *It is arguably Cox's best building.*
- *It is an icon in its own right and contributes significantly to the status of Darling Harbour as an important visitor destination.*
- *It contributes massively to the NSW economy hosting hundreds of events over its short life of 25 years.*
- *As the 1989 Sulman Award winning building it is the fundamental 20th century architectural cornerstone contributing immeasurably to Sydney's cultural capital.*
- *The decision to demolish this building is a clear admission of the failure to conceive it as the centrepiece of a renewed do/ convention centre complex.*
- *The people of NSW are being short-changed by the unnecessary and wrongful removal of this architectural and engineering masterpiece.*

Darryl Conybeare

2.0 Economic Benefits

2.1 Business Case comparisons between the existing Entertainment, Exhibition and Convention facilities and the proposed facilities

2.1.1 Current Situation

The current facilities are heavily booked with an occupancy of approximately 70% and trade profitably.

Current Turnover and Profit

According to the SHFA Annual Report 2011 – 2012 the Sydney Convention and Exhibition Centres performed as follows:

- Income $68,186,000
- Expenses $58,116,000
- Operating Profit **$10,070,000**

As the Entertainment is grouped into "Other Major Assets" its individual performance is not transparent in the report. Other Major Assets performance was:

- Income $12,248,000
- Expenses $8,935,000
- Operating Profit **$3,313,000**

Current Value

Note: According to the PWC Report September, 2010 the current facility cost $287 million (or $630 million in 2010's dollars), with a $57 million extension opened in 1999

($85 million in 2010's dollars). Total - $715 million in 2010's dollars.

Current Economic Benefit to NSW

According to the SHFA Annual Report 2011 – 2012 the Sydney Convention and Exhibition Centres are estimated to contribute $431.48 million for the year.

2.1.2 The Case for Expansion

Lost Business for NSW and the Need for Expanded Facilities

The 2007 HVS Report "Revitalising the Convention and Exhibition Industry in Sydney" prepared for the Property Council of Australia and Tourism and Tourism Forum noted that an estimated 554 events between were lost to NSW due to the lack of facilities at peak periods. Whilst it concluded that not all of these events could be won with expanded facilities, it estimated that approximately $160 million in additional benefits per annum could be achieved through expanded facilities.

The reported recommended the following increases:

- 10,000 sq metres min of (indoor) exhibition space to bring the total to 37,200 sq metres
- 5,000 sq metres min of meeting and ballroom space to bring the total to 14,736 sq metres
- 1,000 seat theatre to bring the total to 5,500 seats

It also noted that the preferred increase in area of exhibition space would be in the order of 20,000 sq metres.

The NSW Joint Ministerial Taskforce on Tourism, Planning and Investment reached a similar conclusion in its recommendation in 2010 to the NSW Government. The Taskforce included members from the Tourism Industry of NSW, Tourism and Transport Forum, Property Council of Australia and Sydney City Council.

PWC Report "A World Class Convention and Exhibition Centre for Sydney: Prefeasibility Study" September, 2010

The Report was prepared for the Australian Tourism Export Council, Infrastructure Partnerships Australia, the Property Council of Australia, Sydney Business Chamber and Tourism and Transport Forum. It was addressed to the then Leader of the Opposition.

The Report states the following:

"As discussed, the expansion of the SCEC has the potential to increase economic benefits received by NSW (currently $466 million per annum) by $160 million each year for expansion into the SEC car park, and up to $270 million each year for expansion into the SEC car park and SEC site, as described above.

The annual net cost to government for an expanded SCEC procured through a service payment PPP is estimated at $40 to $60 million.

The estimated cost assumes a 30 year PPP project term with an initial capital cost of $500 million, which is offset by the realisation of commercial revenue opportunities. The quantum of commercial revenue offset reflects indicative proposals received from the private sector for an expanded SCEC."

The Report states that the cost to redevelop the SEC Car Park would be approx. $500 million for an additional 10,000 sq metres of exhibition space. For the SEC site and SEC Car Park, for $500-$750 million a total of 20,000 sq metres of meeting and exhibition space could be achieved.

The Report notes that a benefit of expansion is that the existing facilities can continue to trade.

The SICEEP Brief

When the NSW Government issued the brief for the new SICEEP, the Premier announced that the facility would have as a minimum:

- Exhibition Space of 40,000 sq metres
- Plenary spaces to host a total of 10,000 delegates
- A Sports/Entertainment space with a minimum capacity of 12,000 seats
- Banqueting Facilities for 4,000 persons

The brief was consistent with the previous professional and industry advice.

2.1.3 Current Proposal

The Application lodged states that the estimated cost of the works is $997,200,000. This includes:

- The ICC , GFA 73,000 m^2
- The ICC Exhibition Centre, GFA 56,000 m^2
- The Theatre, GFA 51,500 m^2
- Associated Retail and Car Parking facilities
- Demolition
- Site preparation
- Infrastructure and Upgrades
- amendment to Sydney Metro Light Rail office/maintenance facilities and stations.

Note: Does not mention realignment of Darling Drive

Estimated Economic Contribution to the NSW economy for the new facility is $200 million per annum.

The scheme represents significant shortfalls in relation to the brief requirements and no indication of how the facility can be expanded. The shortfalls include:

- 5,000 sq metres of indoor exhibition space
- 2,000 seats in the banquet room
- 4,000 seats in the sports/entertainment facility

2.1.4 Issues

The proposal raises significant concerns over whether there will be any nett benefit to the economy of NSW from this proposal. It defies professional and industry recommendations and would seem to be an economic impost to the people of NSW over the current situation. Questions that need to be addressed are:

- Why does the estimated economic benefit to the State decline by over $200 million per year under the new proposal?
- What is the cost to the State of a $1 billion PPP per annum?
- What is the quality of the facilities to be delivered?
- What financial risk does the NSW Government undertake in this proposal?
- What additional commitments will the NSW Government undertake in relation to this proposal?

2.1.5 Alternative assessment of the Order of Cost

Rates

Using figures from recent completed facilities and schemes as a benchmark for quality, the expected cost of the facility would be as outlined below.

Convention and Entertainment Centre Rates – Brisbane and Melbourne Convention Centres were approx. $6,500 per metre square in today's rates

Exhibition Centre Rates – the 2008 Sydney Showground expansion proposal was around $3,500 per metre square in today's rates

So say

The ICC – 73,000 x $6,500/$m^2$ = $474,500,000
The ICC Exhibition – 56,000 x $3,500/$m^2$ = $196,000,000
The Theatre – 51,500 x $6,500/$m^2$ = $334,750,000
Total Building Works = $1,005,000

Excluding demolition, infrastructure, Darling Drive, public domain, etc. say another $200 – 300 million.

Total - $1.2 – 1.3 million minimum or 25% more than the estimated cost of the current scheme.

2.1.6 Summary

- Why does the economic benefit to NSW decline from over $400 million to $200 million
- Will the construction cost offered deliver the appropriate level of quality to NSW
- What is the cost to NSW per annum
- What financial risk is taken by NSW

2.2 Darling Harbour Dark

Sydney leads the Australian Exhibition and Convention market. This position will be lost and have to be re-established.

The Proposal will require a complete close down of the exhibition, entertainment and convention facilities for some years. This is quite unnecessary. Darling Harbour can be progressively upgraded, particularly if government takes advantage of the purchase of Harbourside.

Harbourside creates a splendid opportunity to create new facilities on the waterfront.

The precedent for this can be seen in Brisbane where new meeting facilities have been created to refresh the offer.

Similarly in Melbourne facilities are being progressively rolled out to improve the Melbourne offer.

The impact of the closure on surrounding activity and business will be devastating, all for the minor expansion of facilities contemplated by the new proposal. This makes no sense.

2.3 Quality

As outlined above the construction costs identified for the new facilities suggest that the quality required cannot be realized.

There are no detailed specifications established to achieve a high quality product. Consequently it will be very difficult for government to control the final construction and finishes quality demanded for Sydney

3.0 Facility Capacity & Function

3.1 Accommodation Capacity Comparisons

1. Exhibition space

– Existing dedicated exhibition space	27,200 sqm
– Proposed dedicated exhibition space	32,961 sqm

5,760 m² more dedicated exhibition space

2. Column free exhibition space

– Existing column free exhibition space	25,000 sqm
– Proposed column free exhibition space	13,000 sqm

8,000 m² less column free exhibition space

3. Entertainment Capacity

– Existing entertainment / sports seating	10,000 – 12,000 seats
– Proposed entertainment seating	8,000 – 9,000 seats

3,000 fewer entertainment seats

4. Meeting Room Space

– Existing meeting room space	7,077 sqm*
– Proposed meeting room space	8,000 sqm

900 m² more meeting room space

** Note applicant claims that 4,336 sq metres of meeting rooms exist, see below*

3.2 Existing Meeting Rooms Assessment

Figures checked from the SCEC website.

The total area of rooms that are listed for potential meetings (excluding the Bayside Gallery which is generally F&B and some minor offices) are:

Convention Bayside

Convention Centre Bayside, Ground Floor	2,500 sqm
Convention Centre Bayside, Level 1	1,271 sqm
Convention Centre Bayside, Level 2	965 sqm
Convention Centre Bayside, Sub total	4,736 sqm

Convention Parkside

Convention Centre Parkside, Ground Floor	660 sqm
Convention Centre Parkside, Level 1	1,681 sqm
Convention Centre Parkside, Sub total	2,341 sqm

TOTAL	**7,077 sqm**

In summary the new proposal delivers less column free exhibition space, less entertainment capacity, slightly more meeting room space and less than 20% more exhibition space in total.

It is very difficult to understand how this capacity will increase business for Sydney.

3.3 Column Free Space

World class exhibition space should be column free. The new proposal has some 8,000 sqm less column free space. It is hard to see how this will increase Sydney's competitive position in the international exhibition market.

3.4 Single & Multi-level Exhibition Facilities

World best practice demands single level exhibition space capable of being one room.

The existing centre provides 25,000 sqm of column free exhibition space on one level in one room. Competitor venues we have designed have over 60,000 sqm column free on one level, in one room.

This enables maximum flexibility for the venue, ease of bump in bump out with column free space.

There are international examples of multi-level exhibition floors with columns in the space. They are all a compromise, forced by site constraints at each place. Sydney does not have to make these compromises.

3.5 Entertainment Facility Integration

The new entertainment centre does not appear to be integrated with the new exhibition and convention facilities. It is a separate building. It seems to have no more integration than exists today.

3.6 Expansion Capacity

From the day it was completed there has been discussion about the expansion of the existing convention and exhibition facilities, with significant expansion undertaken for the Parkside Convention Centre.

The new proposal appears to have no expansion capacity. This cannot serve Sydney well in the future.

4.0 Public Benefits

We submit that the public benefits do not meet a threshold that would justify such significant changes and costs to the people of NSW.

Significant Sydney heritage such as the Exhibition, Convention and Entertainment centres is lost.

Tumbalong Park is effectively reduced in area

The Urban Stream is destroyed

Sydney gets less column free exhibition space

Sydney gets less space in on one exhibition floor

The entertainment centre is smaller

The entertainment centre would not accommodate sports

The new facility cannot be expanded.

The usable park area is reduced by 14,000 sqm

Views down William Henry & Quarry streets are obstructed

Darling Harbour goes dark for several years

The construction costs may not deliver the quality required

The economic benefit to NSW seems to be reduced from $400 million to $200 million per annum

5.0 Urban Design

5.1 Built Form & Design Excellence

The proposed SICEEP lies on, and beyond the site of the existing Sydney Exhibition Centre and Convention Centre. South of Pier Street, the site includes the Sydney Entertainment Centre and multi storey carpark.

The project site not only encompasses existing buildings but includes public open space at Tumbalong Park, Cockle Bay, Pier Street and around the Sydney Entertainment Centre. Darling Drive and the south forecourt to the Harbourside complex are also included.

The Department of Infrastructure and Planning issued Director General's Requirements for the site. The Proposal identifies its response to these Requirements.

Director General's Requirements

- **Address the height, bulk and scale of the proposed development within the context of the locality;**
- **Address visual impact when viewed from the public domain and key vantage points surrounding the site;**
- **Address design quality, with specific consideration of the overall site layout, siting and design, axis, vistas and connectivity, street activation, open spaces and edges, facades, massing, setbacks and building articulation;**
- **Outline the strategy to ensure design excellence is achieved for the development which should include documentary evidence that the independent Design Review Panel appointed by Infrastructure NSW to oversee the design of the SICEEP project has reviewed the detailed design and their recommendations have been addressed; and**
- **Address the Urban Design and Public Realm Guidelines, prepared by Infrastructure NSW for the SICEEP.**

In response to the Requirements, the proposal focuses on its relationship to the surrounding city but not the existing public domain and the long held principle of a low, human scaled waterfront and open space to the city's edge.

InfrastructureNSW's Urban Design and Public Realm Guidelines (April 2012) is the only "planning" document relating to the site. As a control document, is concerned largely with broadbrush principles about safety, access and materials and clearly fails to identify any specific building height and massing controls within the precinct. The only height controls refer to city streets rather than the park setting of the project.

As a reference document to help guide InfrastructureNSW's Design Review Panel, it offers no guidance, no firm requirements and no framework for the assessment of built form and urban design outcomes.

The outcome of this process where Government has resisted detailed planning controls to maximise the return on the site has resulted in a planning process where the public's amenity and the City's public domain has been compromised. The process has been driven by InfrastructureNSW to meet perceived commercial outcomes rather than a thorough and coordinated planning and urban policy The lack of public involvement and scrutiny during formulation of the development brief and guidelines has resulted in a proposal that is geared towards private commercial return on what is a public asset.

Scale

North of Pier Street, the proposal includes an exhibition centre, convention facilities and a theatre. At up to 45m in height (12-15 storeys), these multi-storey elements are double the height of the existing exhibition halls and more than double the height of the existing convention centre.

South of Pier Street 1,360 units and 32,600m2 of commercial space is proposed in towers close to the scale of the existing Peak building (RL 153m).

Appendix H makes extensive reference to the overall city context and the scale of buildings on the Pyrmont/Ultimo ridge and within the CBD. Matching these heights with development that is in the valley floor both ignores the impact of 12-15 storey buildings on the public domain and the stepped massing of the CBD long promoted by Sydney City.

Within the Tumbalong Park precinct, the most immediate neighbour - the Darling Quarter development - is referenced in diagrammes and the relationship to the built form is not fully addressed.. Built to guidelines developed by SHFA (and a competition process based on an agreed outcome) this building is six storeys (24m) at the park edge stepping up to 8 storeys on Harbour Street. The public domain frontage is half that of the proposal.

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5.0 Urban Design

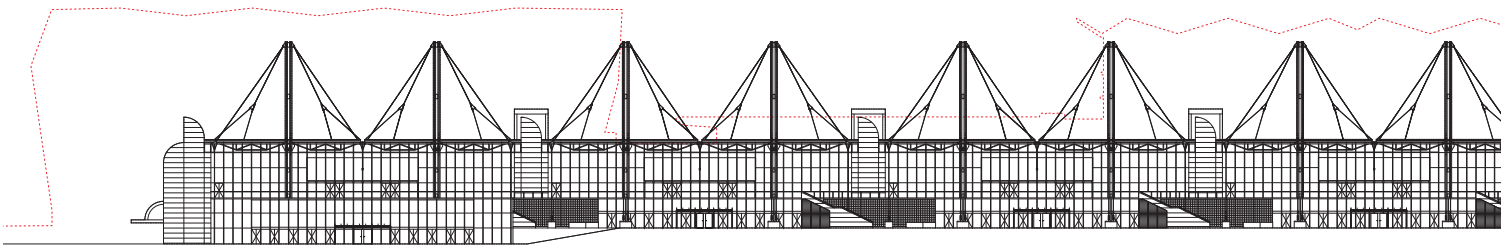


Figure 1: Comparative site elevations

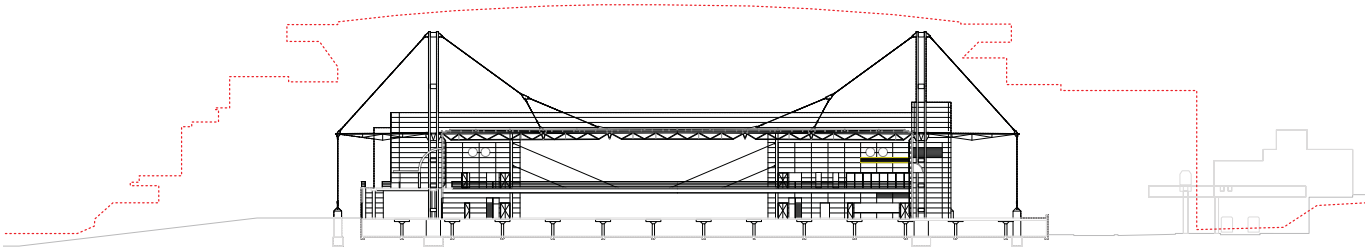
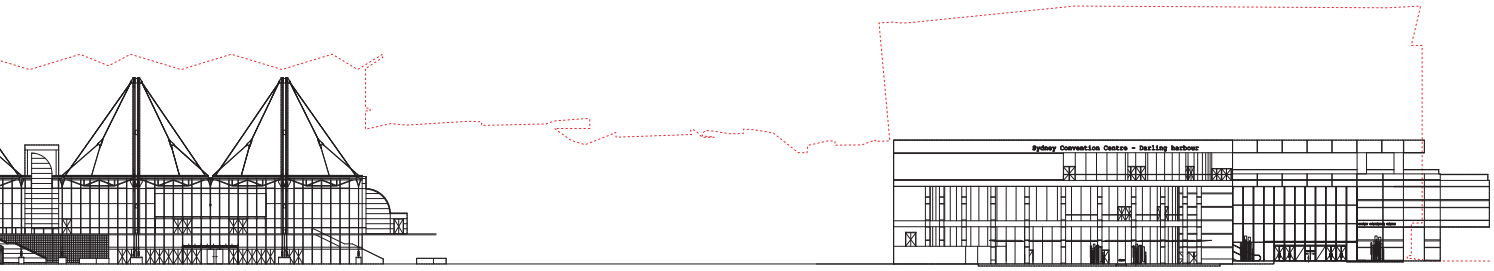


Figure 2: Comparative site section


Sydney Convention Centre - Darling harbour

5.0 Urban Design

Visual Impact

A complex of this scale will have a significant impact on part of Sydney that was conceived and delivered as a public place for the people of Sydney.

Modelling has carefully avoided contentious views and has sought to mask impacts through the addition of landscape elements that, in reality, are unlikely to hide the scale and mitigate the impact of these high rise buildings.

Tumbalong Park

While not illustrated in the Visual assessment document, the impact of a 12-15 storey building within the park will have significant impact on the scale and quality of the public domain.

Views selected for the Visual assessment study carefully avoid the bulk of the main buildings, instead focusing on the lower zone (the scale of the existing Exhibition Centre halls) between the theatre and the proposed exhibition facility.

At 42m in height, this zone is equivalent to a 12 storey commercial or 15 storey residential building.

Landscaped terraces have been introduced to screen the building towards Tumbalong Park however these will be only be 9 metres in height.

A pedestrian link (approximately 25m in width) between Darling Drive and Tumbalong Park will run between the sheer wall of the Theatre (the equivalent of approximately 12-15 stoerys in height) and the lower level of the convention facility (the equivalent of 5-6 Storeys in height).

Impacts from development to the south where new high rise will overlook the park is not adequately described.

Darling Harbour

The height of the proposed convention facilities is at AHD RL 48 - more than double the height of the existing Convention Centre. The immediate impact will be felt along the Cockle Bay foreshore where the building is the equivalent of a shear 12-15 storey wall.

The fountain will be overwhelmed by the scale of the building located only 4-6m from its edge.

Pier Street

The scale of the proposed complex will be immediately apparent from the roads crossing from the city to Ultimo. Pier Street is a major route from the Harbour Bridge and the City, west into Ultimo and Glebe.

Ultimo

From Ultimo, the proposal will block views to the city from both the public and private domain.

Darling Drive

Darling Drive will become an address point for the complex and be effectively privatised. Buildings up to 48m in height (12-15 storeys) are located immediately on the street edgewhere the scale of the complex will overwhelm the street.

At Harbourside, the potential hotel (30+ storeys) will further impact the public domain

Hotel

A hotel option on a site adjacent to Harbourside is included in the proposal. This 30+ storey element (shown in a reassuring translucent blue in the visual assessment) will have a significant impact on both the waterfront environment and on properties behind the site in Ultimo.

The footprint as proposed is constrained and unlikely to accommodate the lower level functions required for a hotel (foyer, kitchens, back of house, etc)

TUMBALONG PARK
SICEEP Ground View Corridor 12a Existing

TUMBALONG PARK
SICEEP Ground View Corridor 12a

TUMBALONG PARK
SICEEP Ground View Corridor 12b Existing

TUMBALONG PARK
SICEEP Ground View Corridor 12b

TUMBALONG PARK
SICEEP Ground View Corridor 12c Existing

TUMBALONG PARK
SICEEP Ground View Corridor 12c

5.0 Urban Design

Darling Harbour

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DARLING HARBOUR EAST
SICEEP Ground View Corridor 06 Existing

DARLING HARBOUR EAST
SICEEP Ground View Corridor 06

WILLIAM HENRY CORRIDOR
SICEEP Ground View Corridor 15 Existing

WILLIAM HENRY CORRIDOR
SICEEP Ground View Corridor 15

QUARRY CORRIDORS
SICEEP Ground View Corridor 11 Existing

QUARRY CORRIDOR
SICEEP Ground View Corridor 11

5.0 Urban Design

Darling Drive

Darling Drive will become an address point for the complex and be effectively privatised. Buildings up to 48m in height (12-15 storeys) are located immediately on the street edgewhere the scale of the complex will overwhelm the street.

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DARLING DRIVE
SICEEP Ground View Corridor 03 Existing

DARLING DRIVE
SICEEP Ground View Corridor 03

BULLECOURT
SICEEP Bullecourt 805 N Existing

BULLECOURT
SICEEP Bullecourt 805 N

DARLING HARBOUR EAST
SICEEP Ground View Corridor 02 Existing

DARLING HARBOUR EAST
SICEEP Ground View Corridor 02

5.0 Urban Design

Public Domain and Urban Design

The open space response for the SICEEP proposal compares the design to Olmsted's Chicago Lakefront and the process to "re-conceived degraded industrial riverfronts in New York City". The suggestion that this design is of the scale, nature and quality of these 19th Century works and that the existing precinct is degraded is both inappropriate and illusory.

The analysis of nett open space gain as demonstrated in Appendix H claims that there will be a nett increase of 3,000m2 in green open space. While there may be additional planted areas (verges, median strips and residential courtyards), the overall area of usable public open space is clearly reduced. Around the most important and most highly used and trafficked spaces around Tumbalong Park and Cockle Bay, there is a significant reduction of useable open space.

Existing area of publicly accessible open space
49,300m2

Proposed area of publicly accessible open space
35,600m2

Director General's Requirements

- **Address all aspects of the public domain such as open spaces within the precinct and footpath, road paving, cycleways, tree planting, footway dining, public art and lighting;**
- **Identify and analyse key pedestrian desire lines to the surrounding area and critical links to the Central Business District;**
- **Address Water Sensitive Urban Design opportunities within the public domain and landscaping;**
- **Address the CPTED for the design of the public domain;**
- **Demonstrate the pedestrian circulation, accessibility and connections on site and to surrounding streets and lanes in a schematic form;**
- **Identify important sight lines and visual connectivity to and through the site; and**
- **Address the Urban Design and Public Realm Guidelines, prepared by Infrastructure NSW for the SICEEP.**

The Event Deck

Located almost 20m above Tumbalong Park and the accessible public domain, the 5,500m2 Event Deck is perched some 6 storeys above ground level at RL21.5. It can expected to be for the exclusive use of the Pre-function space and not the general public.

Large areas of "open space" on the eastern façade will be terraced and inaccessible.

Darling Drive

Under the proposal, Darling Drive will be converted to one lane in each direction. Additional median planting is proposed. The northern section south of the Western Distributor however will be overhung by a loading dock at RL 21.5 which will be close to the level of the Western Distributor. Trucks and service vehicles may be in full view in this area.

Ultimo Pedestrian Network

The extension of the UPN north beyond the Powerhouse Museum has been suggested in the proposal but it is not funded and will not be delivered by the proponents.

While Sydney Harbour Foreshore Authority has commissioned landscape architects Aspect to deliver the zone south of Hay Street to Ultimo Road the corridor north of Hay Street is used by the Sydney Light Rail and there is no pedestrian access.

The proposed grade access between Ultimo and Tumbalong Park needs to negotiate the level change at Pyrmont Street and is blocked by the Light Rail corridor.

DARLING HARBOUR BEFORE

DARLING HARBOUR AFTER

Existing

66,990sqm total public realm
54,982sqm hardscape
12,008sqm softscape

Proposed Overall SICEEP Precinct

77,509sqm total public realm
54,963sqm hardscape
22,546sqm softscape

Comparision of existing and proposed hard and soft public realm areas

OPEN SPACE COMPARISON

6.0 Sustainability

A fundamental of current sustainability practice is the adaption, retention and reuse of existing buildings. Demolition can only be sustainable when the existing building has no further use.

The existing buildings at Darling Harbour are designed to be and remain fit for purpose.

In fact the existing Exhibition Centre provides more column free space in one room than the replacement proposal.

The existing Entertainment Centre has a much higher capacity than the replacement proposal.

The existing landscape has mature trees, perfectly suitable for their location.

There can be no sustainability justification for the removal of these trees or the demolition of these buildings.

7.0 Master Plan Options

Good practice would explore options for the site to identify the best master plan structure for the site and for Sydney.

No options are offered for consultation in the application.

The application does not address the previous master plan work done by JPW.

We understand that Government is in negotiation for the purchase of the Harbourside lease. This option has not been and should be examined. In fact this option was submitted by COX to INSW in March 2012.

Harbourside offers great exhibition and exhibition opportunity on Sydney Harbour.

We have included this option within the submission.

Key advantages are:

- It protects significant NSW heritage including Sydney Exhibition and Convention Centre, Tumbalong Park and the Urban Stream.
- It celebrates Australia's Bicentenary
- It also enables choice about the future the Entertainment Centre
- It creates world class facilities in a world class location
- It enables additional meeting, banqueting and exhibition space
- It retains 25,000 sqm exhibition space, column free, on one level
- It enable continuous operation of the facility
- It provides better value for money
- It retains Darling Harbour South in public ownership.

8.0 Consultation Process

8.1 Cox Consultation & Information from December 2011

In December 2011 COX advised INSW that we considered that The Sir John Sulman Award winning Sydney Exhibition Centre designed by COX for the 1988 Australian Bicentenary was a building of significance, including supporting information to support the claim.

In April 2012 COX submitted a more detailed report to INSW on the significance of the building, copied to Sam Haddad, Director General of the Department of Planning, Peter Poulet, NSW Government Architect and Dick Persson, Chairman of the Sydney Harbour Foreshore Authority. (This document dated March 2012 forms part of our submission)

Throughout the process our position has been very clear to all parties.

It came as a great surprise to COX that there was no assessment of the significance of the Exhibition Building in the application.

The consultation process appears to be quite flawed.

8.2 SICEEP Urban Design Guideline Consultation Process

INFSW has prepared Urban Design Guidelines for the precinct.

These guidelines appear to have been through no public consultation process.

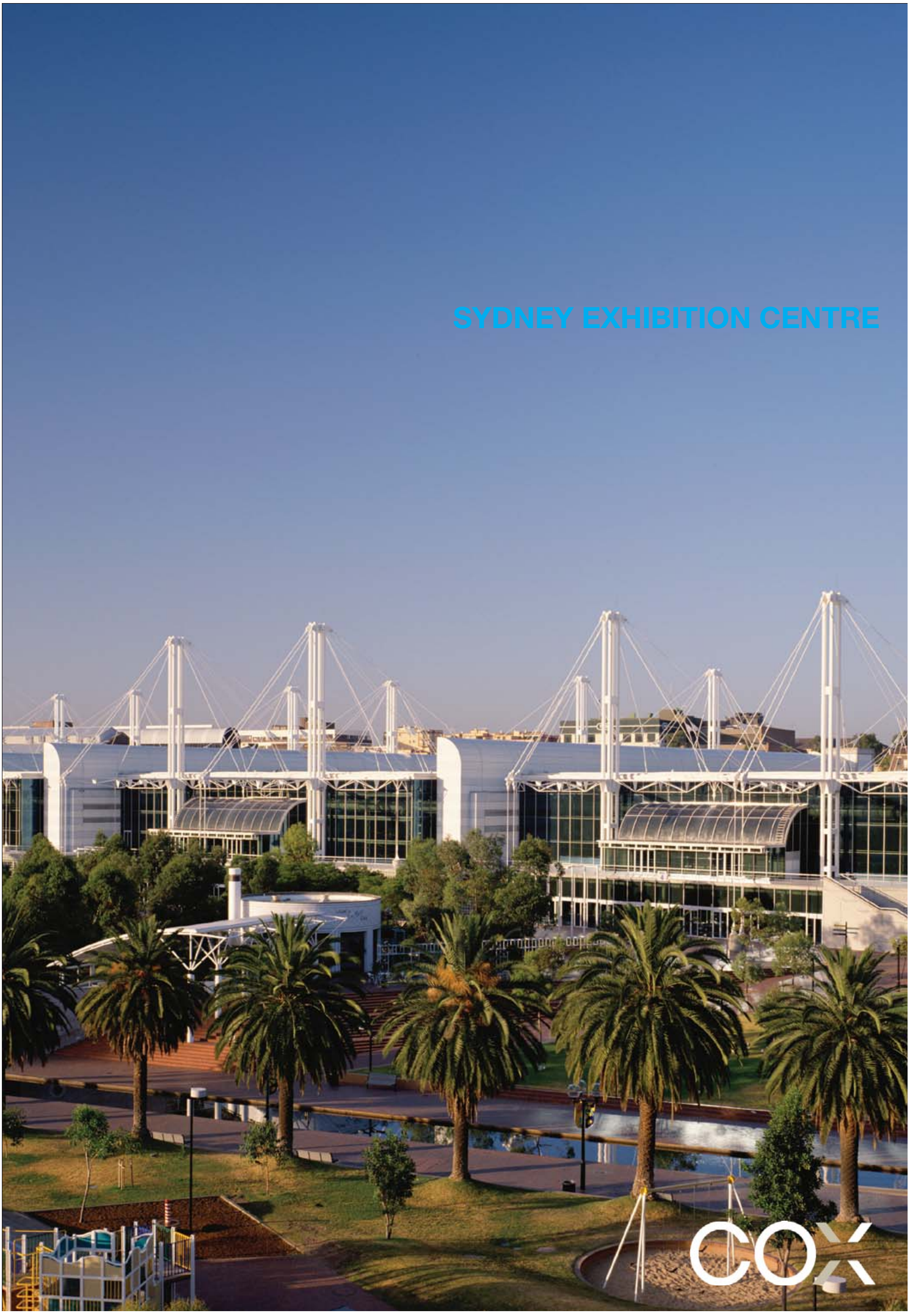
The guidelines are without clear controls. Darling Harbour as it exists today would seem to comply.

9.0 Appendices

Appendix 1	Sydney Exhibition Centre, Short Form Significance Report
Appendix 2	Report on the Significance of Sydney Exhibition Centre, March 2012
Appendix 3	Sydney Exhibition Centre, National Trust Heritage Listing
Appendix 4	Sydney Exhibition Centre, AIA Listing
Appendix 5	Cox Alternative Master Plan Option, March 2012
Appendix 6	Darling Harbour, Andrew Andersons. 2013

Appendix 1
Sydney Exhibition Centre, Short Form Significance Report

SYDNEY EXHIBITION CENTRE



01 Overview

Introduction

The Sydney Exhibition Centre is a significant building for Sydney, recognised internationally as an outstanding architectural building of the twentieth century.

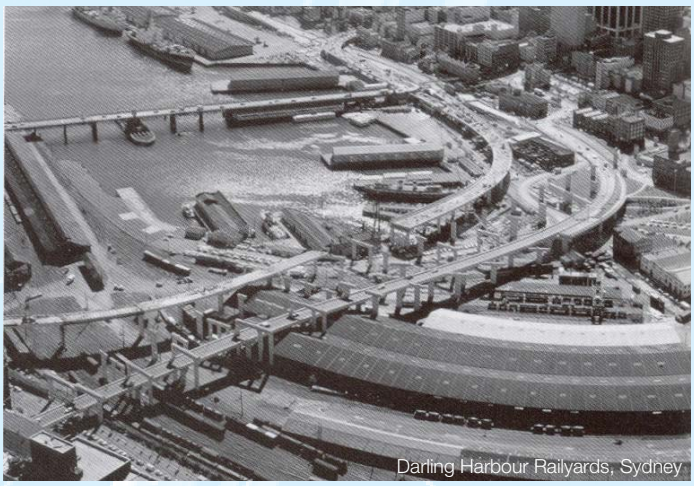
Comprising five interconnected halls, each of 5,000 square metres, an underground 1,000 space car park; it is one of three public buildings undertaken by the practice in the Darling Harbour Redevelopment Area, adjacent to Sydney's CBD.

The concept for the centre principally arose from four objectives. The first was to continue the tradition of structurally innovative exhibition centres dating back to Joseph Paxton's steel, wood and glass Crystal Palace in London. The second was to establish an integral relationship with a new park stretched along one frontage. Thirdly, it sought to convey a distinctive maritime theme conducive to a historic harbour port and finally, it needed to achieve 100 metre spans without creating a massively scaled edifice.

These objectives were met by a continuous mast and rod structure, proving to be both economical and to allow a low horizontal scale to be developed. From concept design, the entire project took 32 months to complete.

Since completion it has been acclaimed by the local MICE industry as an outstanding success. It remains today part of the leading convention and exhibition centre in Australia despite growing competition interstate. It continues to meet the functional and operational requirements of convenors and exhibitors.

02 Historic and Cultural Significance



Darling Harbour Railyards, Sydney

Historical Significance

The Sydney Exhibition Centre was the first major exhibition centre to be built in Australia since the Garden Palace. The Garden Palace was built in 1879 in the Royal Botanical Gardens to commemorate Australia's Centenary. It was destroyed by fire less than three years after completion, leaving Sydney without an international standard exhibition facility for over a century.

It was also one of the key developments in establishing the redeveloped Darling Harbour Precinct in Sydney and anchoring Darling Harbour South.

Crystal Palace, London

Garden Palace, Sydney

Cultural Significance

The Centre was constructed to celebrate Australia's 1988 Bicentenary. Key events were hosted in the Centre including an official State Bicentenary Dinner and the Bicentenary Exhibition.

Since then the Centre has been used as the NSW principle venue for international events and conferences. A highlight being the venue's prime role for the Sydney 2000 Olympic Games, bringing the Games to the CBD. It was the venue for boxing, wrestling, weightlifting, fencing and judo with a total seating capacity for over 30,000 spectators.

1988 Bicentenary Darling Harbour, Sydney

03 Technological Significance

Technological Significance

The structural system for the Centre established new benchmarks in long span building design. Apart from its structural applicability, the mast and rod formation is intended to have an abstract nautical metaphor, thematically continued in its outriggers, bridges and panelled steel cladding.

A highly efficient structure, the building was erected in a short period of time. The integrated roof structure and cladding system allowed for easy and safe erection with minimal scaffolding.

In designing the facility, new standards were also established for fire engineering and fire safety. Research into crowd behaviour and fire loads helped established rational and economic approaches that have benefited many projects since and led to the alternative solution principles of the current codes.

This has been recognised internationally with the Centre being selected as a Finalist in the 1988 World Quaternario Awards and various national and state engineering awards such as the Commendation Building and Civil Design, National Engineering Excellence Awards 1988.

04 Urban Design Significance

Urban Design Significance

The Centre is a major component of South Darling Harbour, framing Tumbalong Park along its west edge. It is raised to overlook the park and articulated so that it is possible to view the park from within as well as to obtain views to the inside of the Centre from the park.

It recognises both immediate and distant context, and it produces abstract metaphor for a number of themes related to its place. It is stretched in staggered formation along the western edge of the Darling Harbour Park from freeway to freeway. Virtually its entire park face is glazed, broken only by the set backs which identify each of its five 5,000 square metre halls.

Despite the immediate relationship to the garden context, the horizontality of the building repeats the form of the woolstores and warehouses of Ultimo behind, reinforced by the silhouette of the vertical masts. In order to preserve the garden elevation as a public interface between park and exhibition, the rear elevation is entirely devoted to docking and service facilities and these appropriately face the historic warehouse district of Ultimo.

05 Architectural Significance

Architectural Significance

The Centre has been recognised nationally and internationally as being of considerable merit. It has been covered by journals around the world.

It has been recognised by the Australia Institute of Architects for its excellence. In 1989, it was awarded the Sir John Sulman Medal RAIA (NSW Chapter) by a committee chaired by Harry Seidler. In the same year it was a finalist for the Sir Zelman Cowan Award.

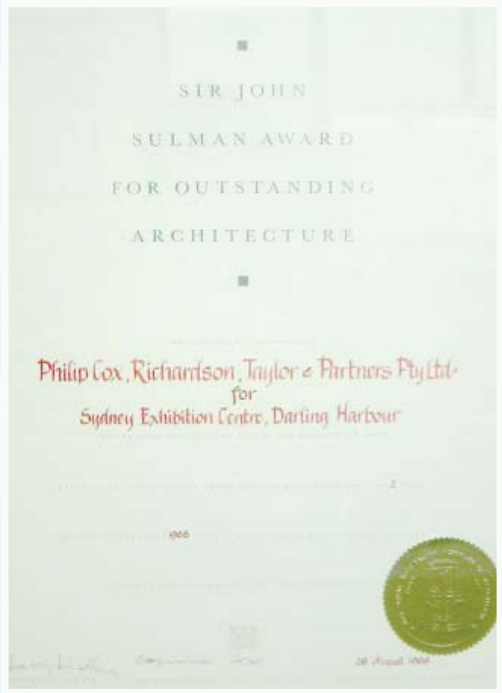
Internationally it is mentioned in Bannister Fletcher, the authoritative book on world architecture, as an important contribution to World and Australian Architecture.

It is also mentioned as an example by excellence by Scharpe as an outstanding example of Twentieth Century Architecture.

In 2010, the Centre took out the title of Australasia's Leading Meetings and Conference Centres in the World Travel Awards for the fifth consecutive year.

Thousands of industry travel professionals voted in the awards with the venue winning over a number of other regional venues.

The Centre continues to win awards for venue excellence and, in 2012, the Centre won Best Venue in the Australian Event Awards.



06 Heritage

Heritage

The Sydney Exhibition Centre has been listed as an item of heritage by the Australian Institute of Architects and the National Trust.

It is listed by the AIA under the NSW Significant 20th Century Architecture category, item number 4700327 on the NSW Institute Register.

In the National Trust's Statement of Significance in its Listing Report, it is noted that the "Sydney Exhibition Centre is an exemplar of collaboration between architect and engineer" and "is acknowledged as an aesthetically distinctive design" and "established new benchmarks in building design for the construction industry".

A nomination to the State's Heritage Register is currently being considered by the NSW Heritage Council.

07 Fact Sheet

Fact Sheet

Location	Darling Harbour, Sydney within 0.5 km of the CBD. It is located to the south of the adjoining Convention Centre. Convention Centre South was designed by Anchor Mortlock Woolley and completed in 1998. Convention Centre North was designed by John Andrews International and completed in 1988.
Commenced	1985
Completed	1988
Capital Cost	$80 million
Ownership	Sydney Foreshore Authority is responsible for the entire Darling Harbour precinct on behalf of NSW Government. The Convention Centre operation is managed by Darling Harbour Convention and Exhibition (DHCE) Pty Ltd, a company owned by CCM (Convention Centre Management Pty Ltd), which is in turn owned by Accor Asia Pacific (60%) and Compass Group (Australia) (40%). Accor Asia Pacific is wholly owned by its parent company, French-based Accor SA, the world's largest hotel and tourism corporation. Compass Group (Australia) Pty Ltd is a subsidiary of the global Compass PLC food services organisation.
Design Team	Architects – Cox, Richardson, Taylor and Partners Structural Engineer – Ove Arup and Partners Civil Engineer – Ove Arup Mechanical – W E Bassett Electrical – Addicoat, Hogarth and Wilson Communications – Addicoat, Hogarth and Wilson Hydraulic – Creasey Murray Acoustic – Peter Knowland
Contractor	Leighton Contractors
Exhibition Space	27,200 square metres Grade A space, including 5 halls of 5,000 square each with 12+ metres clear height
Parking	900 undercover car spaces
Economic Impact	The estimated delegate/visitor expenditure in FY 2010 for domestic and international business for exhibitions only was $79 mil. The total with conventions, etc. was over $500 mil.

Major Events	1988 – Australian Bicentennial 2000 – Sydney 2000 Olympic Games
Major Industry Awards	2012 Australian Event Awards: Best Venue 2001,2003 to 2011 World Travel Awards - Australasia's Leading Meeting and Conference Centre 2008 to 2011 Events Industry Association of Australasia – Best Green Initiative Award – 2009 and 2011 – Green Globe Silver Certification 2011 EarthCheck – Silver Certification 2010 Meetings and Events Australia National Awards – Best Meeting Venue for 500+ delegates
Design Awards	1989 – Sir John Sulman Medal – RAIA (NSW Chapter) 1989 – Sir Zelman Cowan Award Finalist – RAIA 1988 – Commendation Building and Civil Design – National Engineering Awards 1988 – ACEA Special Merit Award 1988 – Finalist World Quaterario Awards 1987 – IE Australia Sydney Division Winner – Building and Civil Design (Roof Structure) 1987 – IE Australia – Highly Commended - Building and Civil Design (Roof Structure)
Heritage Listings	New South Wales Significant 20th Century Architecture – AIA National Trust Nominated to the NSW Heritage Office for the NSW State Heritage Register

Appendix 2
Report on the Significance of Sydney Exhibition Centre
March 2012

SYDNEY EXHIBITION CENTRE

Report on Significance

Prepared by Cox Richardson
March 2012

01
Overview

Introduction

The Sydney Exhibition Centre was built in 1988 by the Darling Harbour Authority, on behalf of the New South Wales State Government.

In 2001 the Darling Harbour Authority, along with Sydney Cove Authority and City West Development Corporation was incorporated into Sydney Harbour Foreshore Authority.

In conjunction with the Convention North and South Buildings, the Exhibition Centre is a key component of the Sydney Convention and Exhibition Centre.

The Exhibition Centre is a significant building for Sydney, recognised internationally as an outstanding architectural building of the twentieth century.

Comprising five interconnected halls, each of 5,000 square metres and an underground 1,000 space car park; it is one of three public buildings undertaken by the practice in the Darling Harbour Redevelopment Area, adjacent to Sydney's CBD.

The concept for the centre principally arose from four objectives. The first was to continue the tradition of structurally innovative exhibition centres dating back to Joseph Paxton's steel, wood and glass Crystal Palace in London. The second was to establish an integral relationship with a new park stretched along one frontage. Thirdly, it sought to convey a distinctive maritime theme conducive to a historic harbour port and finally, it needed to achieve 100 metre spans without creating a massively scaled edifice.

These objectives were met by a continuous mast and cable structure, proving to be both economical and to allow a low horizontal scale to be developed. From concept design, the entire project took 32 months to complete.

Since completion it has been acclaimed by the local MICE industry as an outstanding success. It remains today the leading convention and exhibition centre in Australia despite growing competition interstate. It continues to meet the functional and operational requirements of convenors and exhibitors.

02
Industry Significance

Industry Significance

The Sydney Convention and Exhibition Centre was the first modern facility built in Australia post World War 2. On completion it established Sydney as a leading Convention and Exhibition destination.

It continues to be recognised as a leading facility in the Asia Pacific region and an environmentally sustainable venue. Recent acknowledgements include:

2001, 2003 - 11	Australasia's Leading Meetings and Conference Centre by the World Travel Awards
2008 – 2011	Best Green Initiative Award Events Industry Association of Australasia
2009 and 2011	Green Globe Silver Certification
2010	Australian Event Awards Spice Magazine Best Venue
2011	Silver Certification by EarthCheck
2011	National Award for the Best Meeting Venue for 500 delegates plus by the Meetings and Events Australia

03

Historic & Social Significance

Historical Significance

The Sydney Exhibition Centre was the first major exhibition centre to be built in Australia since the Garden Palace. The Garden Palace was built in 1879 in the Royal Botanical Gardens to commemorate Australia's Centenary. It was destroyed by fire less than three years after completion, leaving Sydney without an international standard exhibition facility for over a century.

It was also one of the key developments in establishing the redeveloped Darling Harbour Precinct in Sydney and anchoring Darling Harbour South.

Social Significance

The Sydney Exhibition Centre's social significance is primarily derived from its continued use as the principle NSW venue for events, exhibitions and conferences attracting a large audience from far and wide. It is the premier exhibition centre in Australia and has been a major contributor to commercial development in New South Wales.

The Bicentennial projects brought international focus on Australia and Australian architecture.

Since then the Centre has continued as NSW's principle venue for international events and conferences. A highlight being the venue's prime role for the Sydney 2000 Olympic Games, bringing the Games to the CBD. It was the venue for boxing, wrestling, weightlifting, fencing and judo with a total seating capacity for over 30,000 spectators.

Garden Palace, Sydney
Photography by Messrs Richards and Company
Collection: Powerhouse Museum, Sydney

1988 Bicentenary Darling Harbour, Sydney

04
Technological Significance

Technological Significance

The Exhibition Centre is acknowledged as one of exemplary architectural design for its period and was a significant technical achievement. The use of a long-span masted tension structural system established new benchmarks in building design for the construction industry; after 1988 the practice's 'white stadia expressionism' was adopted globally by other architects influencing the design of international sports and exhibition facilities.

The structural system for the Centre established new benchmarks in long span building design. Apart from its structural applicability, the mast and cable formation is intended to have an abstract nautical metaphor, thematically continued in its outriggers, bridges and panelled steel cladding.

A highly efficient structure, the building was erected in a short period of time. The integrated roof structure and cladding system allowed for easy and safe erection with minimal scaffolding.

In designing the facility, new standards were also established for fire engineering and fire safety. Research into crowd behaviour and fire loads helped established rational and economic approaches that have benefited many projects since and led to the alternative solution principles of the current codes.

This has been recognised internationally with the Centre being selected as a Finalist in the 1988 World Quaternario Awards and various national and state engineering awards such as the Building and Civil Design for the Roof Structure in 1987, the Commendation Building and Civil Design 1988, National Engineering Excellence Awards, plus the ACEA Special Merit Award 1988.

05
Urban Design Significance

Urban Design Significance

The Centre is a major component of South Darling Harbour, framing Tumbalong Park along its west edge. It is raised to overlook the park and articulated so that it is possible to view the park from within as well as to obtain views to the inside of the Centre from the park.

It recognises both immediate and distant context, and it produces abstract metaphor for a number of themes related to its place. It is stretched in staggered formation along the western edge of the Darling Harbour Park from freeway to freeway. Virtually its entire park face is glazed, broken only by the set backs which identify each of its five 5,000 square metre halls.

Despite the immediate relationship to the garden context, the horizontality of the building repeats the form of the wool stores and warehouses of Ultimo behind, reinforced by the silhouette of the vertical masts. In order to preserve the garden elevation as a public interface between park and exhibition, the rear elevation is entirely devoted to docking and service facilities and these appropriately face the historic warehouse district of Ultimo.

06
Architectural Significance

Architectural Significance

The Sydney Exhibition Centre is critically acclaimed nationally and internationally as a significant example of Twentieth Century architecture demonstrating a high level of creativity in its concept, and a high level of integrity in the execution of the original design concept. The Centre has been recognised nationally and internationally as being of considerable merit. It has been covered by journals around the world.

It has been recognised by the Australian Institute of Architects for its excellence. In 1989, it was awarded the Sir John Sulman Medal RAIA (NSW Chapter) by a committee chaired by Harry Seidler. In the same year it was a finalist for the Sir Zelman Cowan Award.

The Exhibition Centre is an excellent example of 1980s steel architecture, which was adopted by Australian architects and referred to in Apperly's "Identifying Australian Architecture" as late twentieth century Structuralist.

Internationally it is mentioned as an example of excellence by Scharpe as outstanding Twentieth Century Architecture.

07
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AWARDS

THE SIR ZELMAN COWEN AWARD FINALIST

Philip Cox, Richardson, Taylor and Partners

HAS BEEN AWARDED THIS CERTIFICATE BY THE

ROYAL AUSTRALIAN INSTITUTE OF ARCHITECTS NATIONAL AWARDS JURY, FOR

The Sydney Exhibition Centre

WHICH WAS A FINALIST IN

THE SIR ZELMAN COWEN AWARD

FOR OUTSTANDING NON-DOMESTIC ARCHITECTURE

Chairman RAIA National Jury

27 October 1989

Dated

SIR JOHN SULMAN AWARD FOR OUTSTANDING ARCHITECTURE

Philip Cox, Richardson, Taylor & Partners Pty Ltd

for

Sydney Exhibition Centre, Darling Harbour

1988

28 August 1989

THE INSTITUTION OF ENGINEERS, AUSTRALIA

NATIONAL ENGINEERING EXCELLENCE AWARDS

CERTIFICATE

Building and Civil Design

HIGHLY COMMENDED

This commendation is presented to

Philip Cox, Richardson, Taylor & Partners, Architects

for Roof Structure
of the Darling Harbour
Exhibition Building

David E Sharrington
FOR SECRETARY

21st February 1988

PUBLICATIONS

1988

Philip Cox, Richardson and Taylor, *Sydney Football Stadium*, Sydney, Australia, 1980 (1986–88)
Right: the stadium's ribbon roof is held on a network of steel supports
Below: inside the arena
Bottom: plan and elevational perspective

Built adjacent to the world-famous Sydney Cricket Ground, this spectacular stadium accommodates all types of football at national and international level. It is described locally as the Sydney 'roller coaster' and is one of Cox's most visually exciting structures. It can hold almost 80,000 spectators. Its curved forms – developed by Arup's – are accentuated by the giant ribbon of steel sheet roof that sweeps up above the 3- or 5-storey boxed stands and then down over the lower-level terraces. The roof is supported on a series of steel trusses, which in turn carry the weight of the roof down concrete-encased stanchions. The ribbon roof itself is continuous and sweeps up over the east and west enclosure stand, dipping down over the lower terraces to the north and south of the ground. The grandstand seating, angled at 30 degrees, is supported on a 3- or 4-storey concrete substructure in which are housed the various ground facilities including restaurant, bars, toilets and clubrooms. Adjacent to the pitch and below these structures, a concrete terraced slab of seating has been dug into the earth, the last row of which comes right up to the elegant grass playing surface. There are no barriers between spectators and sport. The huge cantilevered steel roof is supported by a series of steel trusses which transfer vertical loads downwards to the perimeter Universal Steel columns. Steel-to-steel connections were made possible throughout the project for simplicity of construction, although they have now been concrete-encased for fire-proofing purposes.

The major NSW Bicentennial project for 1988 in Sydney was the Darling Harbour redevelopment. Cox's firm produced three major structures. Amid a veritable armada of tall buildings, the small, unusual, and exciting Sydney Aquarium looks like a beached whale or some prehistoric sea

Philip Cox, Richardson and Taylor, *Darling Harbour Redevelopment and Museum Area*, Aquarium and National Maritime Museum, Exhibition Halls and Congress Centre, Sydney, Australia, 1980 (1986–88)
Left: Darling Harbour with the new Aquarium
Centre: the Aquarium under construction
Bottom: details of the construction and supports for the exhibition halls

beast, shiny and full-scaled. It differs from all the other buildings in that it was a privately funded building and focuses on an activity below the water rather than on top! In fact it is part building, part barge. It has three sections: an earthbound display; an exhibition and visitor centre; and a restaurant. To its north are three floating and semi-submerged freely moving tanks in which an Oceanarium is situated, allowing spectators to walk literally through walkways surrounded by water and varieties of sea life. The third structure, the Maritime Service Board Wharf No 10, also to the north, houses the support services and labs. The tanks, looking like small barges or ships moored to the wharf are covered by fabric roofs hung from masts and steel cables, all of which further extend in terms of maritime metaphors. The sensation of walking in a boat rather than on hard land is an important feature of this enterprising exhibition.

A. Sydney Football Stadium (1988). See p. 1655

B. National Athletics Stadium, Bruce (1974). See p. 1655

Outward-curving walls divide the plan into a central zone containing the public rooms and the executive accommodation and enclaves containing the House of Representatives and the Senate. The central Meeting Hall is celebrated by means of a huge flag on a 65 m (213 ft) high stainless-steel flagpole. It is an orderly, Classical composition which draws its inspiration from the natural and man-made features of its setting.

The **Swimming Training Halls, Bruce**, Australian Capital Territory (1982), by Daryl Jackson (born 1937) Architects, is one of a group of sports buildings by Jackson which forms a part of the National Sports Centre. The curved, stepped levels of the roof allow natural light into the pool area and help to relate the building to the soft contours of the surrounding hills.

The **Sydney Football Stadium** (1988) (p. 1654A) by Philip Cox (born 1939) and Partners, is one of five major steel structures completed by the firm in that year. These are refined and exuberant buildings that combine advanced technology with a fanciful romanticism that derives inspiration from context. Cox's seminal building of this type is the **National Athletics Stadium, Bruce** (1974) (p. 1654B), a steel tension structure subtly related to banked-earth forms. Cox's major Olympic buildings such as the **Aquatic Centre, Sydney** (1994) provide further refinement in technological development and the generation of expressive form.

Churches and Education Buildings

S. Andrew's Presbyterian Church, Brisbane (1907), by C. D. Payne, is an austere, strongly massed brick building. Simplified Romanesque elements suggest the early influence of America, notably the severe style of H. H. Richardson. **Newman College, University of Melbourne** (1917) (p. 1656A), by Walter Burley Griffin (1876–1937) (in association with Augustus Fritsch), is a heavy, stone building with student rooms around a courtyard. The circular refectory has a concrete ribbed dome. A historic atmosphere is suggested by leaded windows, heavy piers and particularly low storey heights. But the building is strikingly original in its massing, and in the geometry of some of its elements such as window surrounds.

Tamrookum Church, Beaudesert, Queensland (1915) (p. 1655B), by Robin Dods (1868–1920), is dramatically sited on the knoll of a hill in the midst of rolling pastureland. It combines the simple forms of 'village' church architecture with the Queensland timber tradition. Typical of Dods' architecture is his consideration of climate, exemplified here by wide roof-overhangs and french doors opening from the aisles on to generous verandahs.

The **Church of the Resurrection, Keysborough, Melbourne** (1976), by Edmond and Corrigan, is one of a group of church buildings designed for a large site in a new suburb. The two-coloured brickwork, the porch with its verandah and the bay windows are in sympathy with the character of the suburbs in which it stands.

Theatres and other Cultural Buildings

The **Capitol Theatre, Melbourne** (1924), by Walter Burley Griffin (in association with Peck and Kemper), contains Griffin's decorative masterpiece – the illuminated prismatic plaster ceiling. And a few years later the **State Theatre, Sydney** (1929) (p. 1653B), by Henry E. White (1877–1952) (to sketch designs by John Eberson), is a grand 'picture palace' which seats over 2500 people. It forms part of a vertical shopping and office block. Predominantly French Baroque in style, its interiors are moulded in fibrous plaster.

A comparatively early 'high-tech' building, the **Sidney Myer Music Bowl, Melbourne** (1959), by Yuncken, Freeman Brothers, Griffiths and Simpson, is supported by twin steel masts cased in glass fibre. The plywood roof-covering is bolted to secondary transverse cables.

The **Sydney Opera House, Sydney** (p. 1656C), was the subject of an international competition in 1957 and was completed 1973. The competition was won by Jørn Utzon (born 1918). The engineers were Ove Arup and Partners, and Hall, Todd and Littlemore handled the work as architects after 1966. It is composed of two major sections, the solid podium which contains small theatres, exhibition rooms and the service areas and the symphony hall, opera theatre and restaurant which are housed under the white, vaulted roofs poised on the podium. The vaults are formed on pre-cast concrete ribs which follow a curvature of common radius. Monumental stairs lead from the forecourt to the podium. Despite the narrowness of the site, Utzon placed the major auditoria side by side. To achieve this, normal theatre planning is reversed and the stages are placed closest to the entrance, and lounges ideally located overlooking the harbour to the north. The **Victorian Art Centre, Melbourne** (1961–85), by Sir Roy Grounds (1905–81), the **Festival Centre, Adelaide** (1977) (p. 1653D), by Hassell and Partners, and the **Queensland Cultural Centre, Brisbane** (1982–7) by Robin Gibson (born 1930) and Partners, are other notable cultural centres of this period.

Brambuk Living Cultural Centre, Halls Gap (1990), by Gregory Burgess (born 1945) serves as a focus for Aboriginal activities in the area. It is located in a dramatic valley that strongly influenced the sensitive siting, orientation and form. The building is composed of a massive central stone fireplace with an encircling ramp that serves as the fulcrum for the surrounding organic composition of exhibition spaces and ceremonial grounds and gardens. The structure is

VOL 2 NO 8 AUGUST 1987 $3.00

VOICE OF THE METAL BUILDING INDUSTRY

The Darling Harbour's Exhibition Centre is Allco's 'Centrepiece'

Sydney's Darling Harbour project is the largest inner city redevelopment ever undertaken in Australia and its centrepiece is the Exhibition Centre.

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Largest Physical Component

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Continued on page 22

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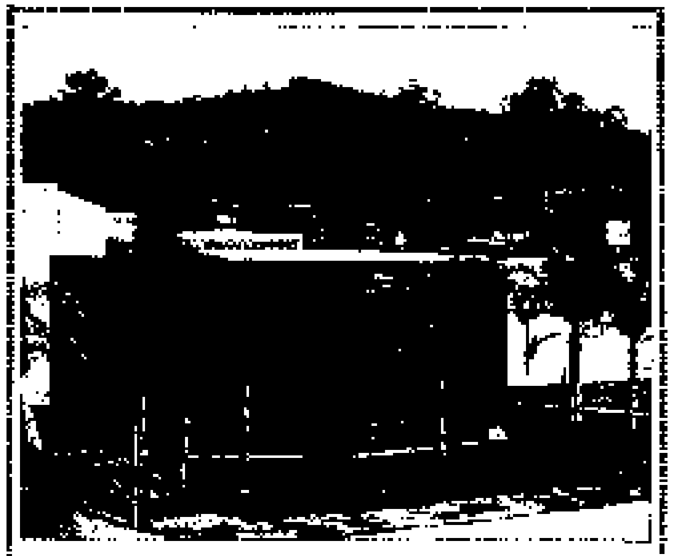

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Carringbush Tower Architect

So that there is no confusion the Sydney architectural firm responsible for the design of the new $175M Carringbush Tower complex is Rice Daubney.

In addition to the Carringbush Tower, Rice Daubney is presently responsible for the design of the following projects that are reaching completion — the Public Authorities Super Annuation Board building in Walker Street, North Sydney, Zenith Centre, Chatswood and the Sacred Heart Hospice at Darlinghurst.

This month MBN continues with part two of Market Overview on the use of CAD/CAM by architects and engineers in relation to the metal building industry. Judging by the favourable response to last month's overview computer software technology is becoming more the norm rather than the exception in contemporary building design.

The Darling Harbour's Exhibition Centre is Allco's 'Centrepiece'

From page 1

Darling Harbour," said John Richardson, from architects Philip Cox and Partners.

"At the same time we had to satisfy the design brief requiring a community exhibition centre with the capacity to house the largest possible exhibitions under one roof."

This was achieved through the novel concept of supporting the roof through suspension rods back to the four steel columns at each hall, using an elegant mast and cable structure of home solid rods and tubular steel. The structure is unique in providing such a large area of clear floor space under one roof.

The use of members forming the structure is of a type and size not frequently used in Australia.

Primary Steelwork

Primary steelwork for each hall comprises four 31m long columns of 406mm CHS tubular steel supporting the circular rod-suspended roof. Separating the halls is a module providing offices, public and mechanical services.

Allco, a major Australian steel fabricator and civil engineering contractor, won the contract in a tender from pre-qualified tenderers for fabrication and erection of the all-important structural steel for the project.

The contract posed many challenges. These were because of the importance of the Darling Harbour Development to the Bicentennial Celebrations, the work had to be done to a defined tight time schedule using fast-track techniques, that it had to be within budget, it had to be interfaced with both the contracts for the concrete works and the finishing trades, and as the nation's premier exhibition centre had to be of the highest quality. Allco met these challenges and completed the project on time and within budget.

After award of the contract in December 1985 Allco immediately began detailed design, project engineering, planning and fabrication.

The contract envisaged there being 2,420 tonnes of steel. This became 2,890 tonnes at finish due to design changes by the client.

Trusses and Braces

Primary roof trusses and braces were fabricated at Allco's Tomago works in New South Wales. Because of the tight schedule, the remaining work went to three sub-contractors who operated under Allco's supervision.

"The fabrication involved something in the order of 150,000 man hours of work," said Laurie Blampied, Allco's project manager. "At the peak of fabrication we had in excess of 200 men working on it."

The pre-production planning involved the Allco-worked-out fabrication methods which ensured timely deliveries with a consistently high degree of accuracy.

Automation was used where possible during fabrication. Information on cutting parts to length and shape was transferred to punched tape which was used to control fabrication machinery.

Mutual Skills

Mutual skills also were important. Complex shapes for the junction of circular hollow sections were checked using flexible templates and marked out and cut by hand to enable a myriad of different types to be made up.

Fast-tracking posed logistic problems and called for good management systems throughout fabrication and finish painting to cope rapidly with last minute design changes. Effective co-ordination through the material procurement, fabrication, painting, transport and erection phases made this possible.

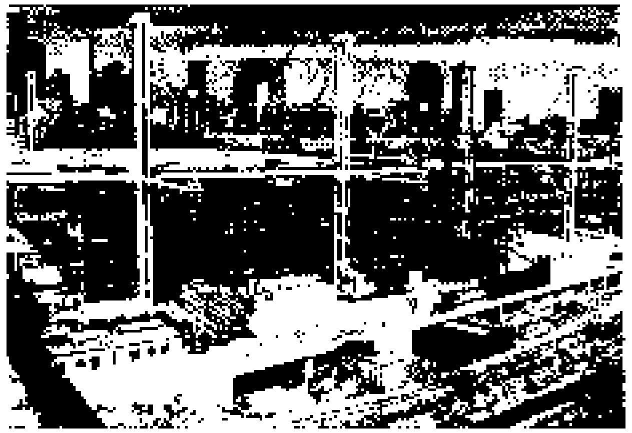
At an early stage Allco Steel proposed an alternative design of the turnbuckles for the suspension system.

Allco's design, developed in conjunction with the structural engineers, Ove Arup & Partners, eliminated a considerable amount of welding and incorporated the supply of two externally threaded components. It simplified the fabrication, assembly and testing of the turnbuckles.

Allco also proposed the use of forging to the [illegible] cross-section from the rod material, which varied from 56mm diameter to 90mm, to the clevis plates for pin connections. This eliminated a considerable amount of machining and enhanced the overall appearance of the assembly.

Because of the critical nature of the suspension rods, all elements had to be rigorously tested.

"The suspension rods are the mainstay of the structure," said Project Manager Laurie Blampied. "If they failed the whole structure would come tumbling down. We therefore had very strict quality control on their fabrication.



The Centre's structure features steel hollow sections which made economical erection. Fabrication involved approximately 150,000 man hours of work. At the peak of fabrication over 200 men were working on the site.

"BHP [illegible] of Newcastle's [illegible] was engaged to assist in the development of a testing program to prove the integrity of the design. Prototypes were tested to destruction prior to full scale production.

"There was also an extensive program of non destructive testing of all elements. Critical suspension rod assemblies were proof-loaded to one and a half times their working load prior to delivery.

"To do that we had to design in conjunction with [illegible] and construct a test bed capable of handling rods of up to 28 metres long and that test bed was pulling to the order of 400 tonnes. That's the equivalent of having 20 semi-trailers hang to all the rods," said Laurie Blampied.

The fine tuning of the suspended roof structure to the final design levels posed some novel engineering problems in order to achieve the specified tolerances [illegible] of the high loads [illegible] the turnbuckles.

Main Roof Gutters

Allco also was deeply involved in the detailed design of the main roof gutters. The final design simplified the [illegible] and ease of installation [illegible] at the same time providing a more visually assertive and robust member.

It was clear from the outset that good planning and operational control would be critical to success.

Availability of storage space was limited by the proximity of the contractor for the concrete works on one side and the need to hand over each hall to the other side progressively to the building contractor for finishing works.

Therefore it became essential to have fabricated steel delivered in a predetermined sequence and schedule. [illegible] considering there would be 30 police-escorted loads which had to be booked six weeks in advance due to the large volume of work in New South Wales tying up the police escort branch.

The Site

The actual site where erection work was carried out was an elevated concrete slab and the large clear span between the main columns should have provided an ideal platform for movement of cranage and material during the erection phase.

However, the true situation which developed as site work progressed was complicated by the lack of barriers between Allco's operations and the concreting contractor and the [illegible] contractor. At times this resulted in access for erection being restricted to half a hall, which hindered movement of cranage.

By the [illegible] coordination of transport from multiple fabrication and storage sites, erection was able to progress to meet completion dates on all elements. This was despite the many [illegible] access routes on public roads and across the Darling Harbour site.

To enable the [illegible] of large segments to site, it was necessary to use specially [illegible] trailers to support loads on three axle [illegible]. These loads, up to 38m in overall length, were transported through the site in the very early hours of the morning under the control of two police escort vehicles to avoid disruption of normal traffic.

Primary Roof Structure

Erection of the roof trusses and the suspension rods which together formed the primary roof structure provided Allco with another challenge. Allco developed an erection method within the guidelines set down by Ove Arup & Partners for the masts, roof trusses and suspension rods.

A-Frame Trestles utilised

Allco's system utilised temporary A-frame trestles (stabilised with 3 tonne concrete counterweights) at the base, incorporating a screw jack system at the trestle head to support the free end of each of the 20 main roof trusses per hall.

The Screw Jacks

Following installation of the suspension rods, the screw jacks enabled fine adjustments to the roof level and allowed adjustment of the suspension rod lengths through the turnbuckle to be undertaken at the "no-load" condition on all rods except the tie-down rods at the back of the columns. These tie-down rods were adjusted by placing hydraulic jacks over the length of the turnbuckle to remove the load through the turnbuckle, enabling easy adjustment.

Lifting Beam

A further aid to simplify and speed erection was the use of a special lifting beam which supported the three rods and the intermediate shackle plate which formed the principal roof support node. For each column there were four of these three-rod sets and a lifting beam enabled each group to be set to the correct slope at ground level and to be fixed in position utilising cherry pickers at the column head and roof level.

The extensive use of cherry pickers was a feature of the steelwork erection. At any one time up to six boom lifts were being used. This allowed Allco to meet the latest requirements of the Construction Safety Act, and maintain their erection program.

Erection methods and aids were designed to facilitate safe working conditions. This management commitment to safety practices resulted in no serious lost time injuries occurring.

The cherry pickers were also necessary to achieve a quality finish since the pre-painted steelwork is an architectural feature of the building and demanded careful handling to avoid damage or soiling. This ruled out traditional rigging procedures.

High Quality Control

Indeed, the white paint system specified to give the building its lightness and cleanliness required special attention to quality control throughout. High quality control at the fabrication stage eliminated the need for adjustment [illegible] during erection.

Quality control was also a feature of the welding. All butt welding for the structure was to category SP and in all cases passed ultrasonic inspection.

The Acid Test

Speed was to be the acid test of all the pre-planning and problem solving initiatives.

The contract was awarded on December 2, 1985, and, by January 23, 1987, 2,890 tonnes of steel had been transformed into five gleaming white halls.

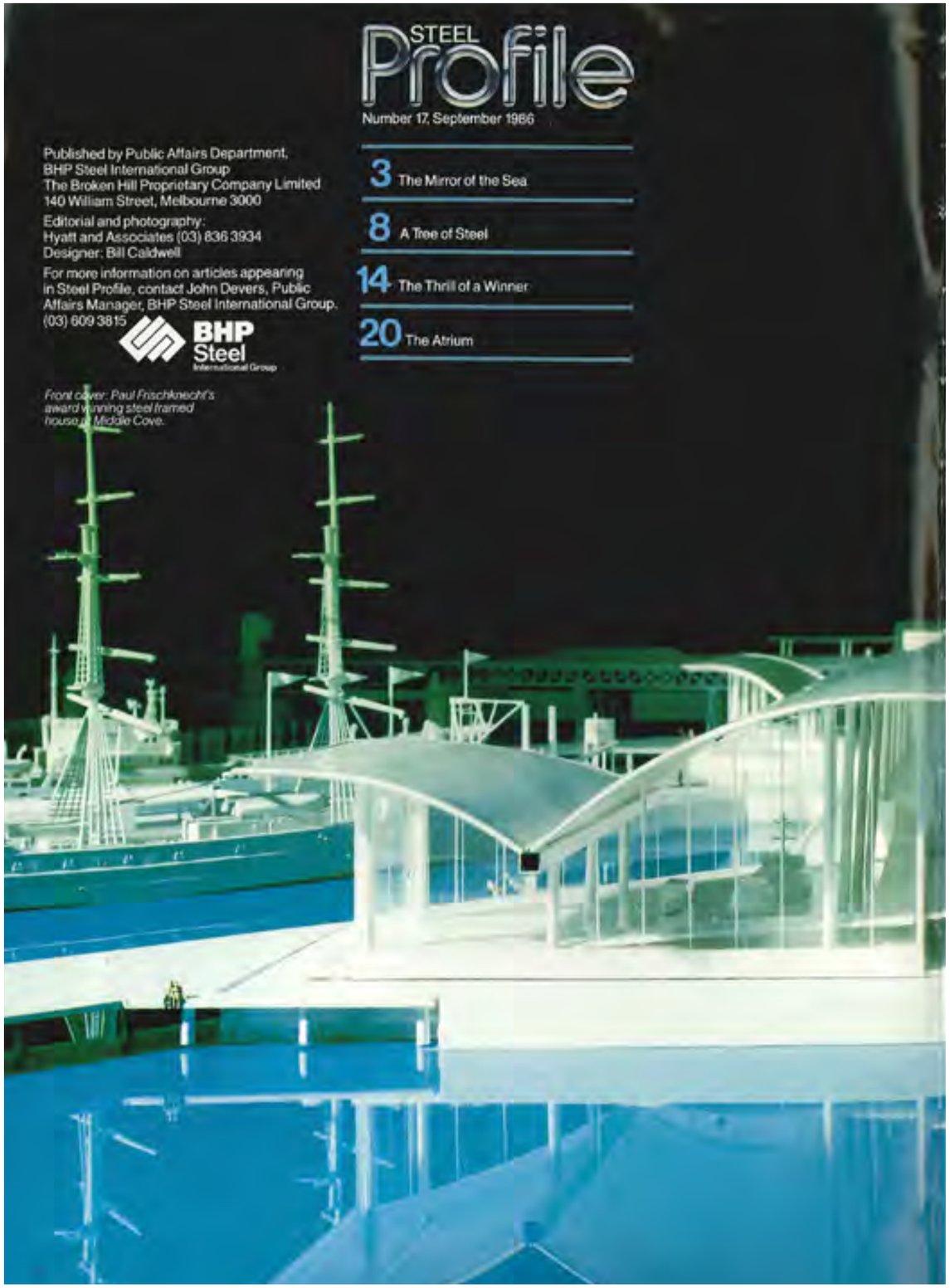
All milestone dates for the handover of each hall were achieved and the contract was completed within budget.

Allco's workforce

That the job was completed ahead of schedule and within budget was a tribute in no small part to Allco's workforce of welders, riggers and crane operators. While 50 per cent of the fabrication was done by subcontract labour because of time constraints, the rest of the fabrication and 100 per cent of erection was by direct labour. Good industrial relations were maintained both on and off site.

Peter Wallace of Leighton, the managing contractor believes the end result is the most innovative building of its type in Australia. "To provide 2.5 hectares of floor space under a 15 ceiling without any vertical columns is a remarkable achievement."

Philip Cox, the architect, said: "On site I've seen the unsurpassable speed and efficiency of using steel in construction. Steel hollow sections in particular, with their ease of erection, handling and maintenance reinforce the economy of using steel. Steel is an innovative material." And steel is Allco's business! ■



STEEL
Profile

Number 17, September 1986

Published by Public Affairs Department,
BHP Steel International Group
The Broken Hill Proprietary Company Limited
140 William Street, Melbourne 3000

Editorial and photography:
Hyatt and Associates (03) 836 3934
Designer: Bill Caldwell

For more information on articles appearing in Steel Profile, contact John Devers, Public Affairs Manager, BHP Steel International Group. (03) 609 3815

BHP Steel International Group

Front cover: Paul Frischknecht's award winning steel framed house at Middle Cove.

The Mirror of the Sea

"These towns of the Antipodes, not so great then as they are now, took an interest in the shipping, the running links with 'home,' . . . This was especially the case in Sydney, where, from the heart of the fair city, down the vista of important streets, could be seen the wool-clippers lying at the Circular Quay – no walled prison-house of a dock that, but the integral part of one of the finest, most beautiful, vast, and safe bays the sun ever shone upon." (Joseph Conrad. The Mirror of the Sea. 1906)

IN another time and place Darling Harbour could be an exotic Pacific port fringed by coconut groves and serviced by clippers heavy with spices, papaya and mangos.

But as gorgeous as it sounds, Darling Harbour is no longer a 'darling'. It is a political nightmare – a town planning nightmare – with lessons, and possibly implications, for all who plan our civic destiny.

The plain fact is that Darling Harbour long ago lost any connection with the world of writer and adventurer Joseph Conrad who was entranced by Sydney's waterways at the turn of the century.

Almost 90 years on from Conrad's visit, the clippers and steamers have long since sailed off into their own sunsets. Today the commerce is tourism. The vehicles for that tourism are Darling Harbour's proposed casino, maritime museum and exhibition centre.

The NSW Labor Government under Neville Wran presented a strong and persuasive argument to keep Sydney in the race lead for international and local tourism.

Darling Harbour National Maritime Museum – part of Philip Cox's design for the area's revival. Photo: Max Dupain.

Of course the whole planning and architectural mix have been plunged headlong into a whirlpool of political intrigue with the proposed monorail designed to service the new facilities. While community debate continues to rage over the monorail, Darling Harbour's other developments – with the exception of the casino and its management – have kept to their backwater, away from the vortex.

Philip Cox, designer of Darling Harbour's maritime museum and exhibition centre has no illusions about the significance of the total development.

He calls it "the most important piece of real estate that's been put together in Sydney in 100 years".

Darling Harbour was the first maritime centre in Australia. The museum will be the only aspect of the Harbour's re-development which is directly related to the original settlement.

Philip Cox, chief architect responsible for the Darling Harbour Exhibition Centre and National Maritime Museum.

The museum will share with the proposed national aquarium, the symbolic Darling Harbour gateway. It has direct visual contact with maritime, merchant, naval and commuter activity in what is still Australia's busiest port.

"It is an opportunity for the State Government to demonstrate that New South Wales is the capital of Australia's commerce.

"Darling Harbour is a fitting and memorable thing," says Cox describing it as, "a tribute and memorable project for the Wran Government to leave."

Of the monorail he remains un-fussed. "I've always believed in the dynamics of cities. The monorail might be here for 20 years, but eventually it will go. Nothing is permanent in this world. If it is as bad as they say, it will go. There will be a tide of reaction against it and in a few years it will be gone."

The monorail aside, the project – reckoned to cost $1200 million – has been described as Australia's greatest urban development. The 50 hectare site within earshot of the city centre is an extraordinary development opportunity which Philip Cox regards with the same deference and respect given to the Yulara Tourist Resort site.

His contribution of exhibition centre and maritime museum maintain the Cox penchant for anti-monumental buildings.

The design includes a series of rising vault forms, reflecting the different spatial volumes required for exhibits.

The themes of a 'living' museum and maritime purpose are conveyed in the building form. A continuous visual relationship will be maintained between the displays and the harbour.

The proposed mast and cable structure reflects the maritime imagery and heritage which is central to Cox's design concepts.

Tubular steel masts support the roof over each hall.
Photo: David Moore.

Philip Cox emphasises the point. "It's not saying 'look at me, see how clever I am'. It is taking an attitude towards buildings and how they can reinforce the environment rather than dominating and proving their own cleverness."

Such attitudes are a hallmark of Cox's work. They are self-evident and remain quite unparalleled in Australia, especially when the scope and enormity of many of his projects are considered.

He remains equally adamant that architecture should be accessible. His exhibition hall and maritime museum are literal expressions and avoid obtuse references or window dressing.

"These are buildings whose intent should be blatant to the man in the street. This is what our firm is aiming at.

"We're not saying you need a Harvard degree to look at a building or to interpret some in-joke design.

"When you see these buildings, the reference to a shipping heritage and elegance is very apparent."

His steel-framed buildings are in themselves minimal structures. Essentially they are suspended, with enormous spans and supported by wire. Cox says the reference to shipping is obvious. If that is true, they also pay homage to technology.

The architect quickly supports the notion and explains that technology is on show as much as the environmental references.

"It is primarily a system to inspire. It has always been that way, whether it has been Gothic cathedrals or Michelangelo doing the domus of St. Peter's in Rome."

Cox is emphatic that the progression of ideas with new technology is his architectural destination.

Design of the Darling Harbour Exhibition Centre.

"It's the technology of man aspiring to the moon and stars. That's the most important thing in architecture."

He has no illusions about the technology of Darling Harbour. He apologises for mentioning such historically astounding work in the same breath. But he makes the point.

"This technology is not earth-shattering, but it's putting architecture back into our context and putting those reference points back into our own cultural tradition.

"I believe that the people who use these buildings will be elated – I hope they will be.

"When they walk through the spaces of massive structures and see how they work, how they are held up, then I believe they will marvel at what they see."

Steel is the preferred construction material for the design which embraces a wide variety of spans and distances. With this system, steel columns will be supported by the podium slab and will support curved roof trusses at nine 15 metre centres. Intermediate sub-frames will be provided between the main roof trusses to reduce the purlin spans to five metres. Construction work is already well underway with completion due in December 1987.

Like most architects, Cox remains sensitive to what he refers to as uninformed and unfair criticism. "I've been accused of favouring steel over other materials, but I can remember being criticised for being on a timber kick.

"It can take years to acquire an understanding of the technology, but we found that with steel in the exhibition centre you can have confidence in its utilisation and you can celebrate this material.

"Steel is superb in tension. If you can make your building as tensile as possible, you therefore minimise the quantity of material and therefore use it in its most economical sense. You know when you have achieved the inherent and right sense of the material. That is when the magic of steel is revealed.

"Properly used," emphasises Cox, "steel has an aesthetic appeal which is now associated with an emerging Australian architecture."

With 25,000 sq.metres of exhibition space, the centre will be one of the biggest tensile steel structures in Australia. Cox's use of steel was deftly handled at Yulara Tourist Resort where he could manipulate the various shades of Australian light.

Similarly at Darling Harbor, his work is an expression of an interest in, and response to, the function and effect of natural light in creating environmental architecture.

Glass will be used extensively in combination with a variety of architectural treatments such as awnings, cantilevers and stair masses, to soften the edge definition and provide continuity between the park and exhibition halls.

His fondness for Yulara and the Darling Harbour project is not borne out of what Cox calls 'camouflage architecture'.

"One can be so sensitive and responsive that you can argue that there should never be another building on this earth.

"I think we proved with Yulara, and I hope we do here, that if you do it with panache and to the right standard, it will work.

"Your solution must recognise those complex factors that will jeopardise your work if you ignore them. So you must take on board those parameters before you put pen to paper.

"If it is a good design it will respond to the political, social, economic and environmental factors."

As an architect who could be fairly described as one of Australia's tall poppies, Cox admits that survival so often depends on the success of an in-built radar system.

"You read the warning signs and adjust your antennae accordingly. But that does not mean becoming the complete pragmatist. You still have to follow through with those ideals."

Cox says that there are two streams of architecture – one of rationality and one of visions and dreams.

"Visions and dreams usually fail to perform because they are too absorbed in unreality. You must synchronise the two. Without the vision there is no architecture – just competent drafting.

"Those things without the spark are not art. You must have the poetry in there somewhere."

His Darling Harbour maritime museum will be an evocative, floating, design pegged to practical function.

In time the structure will emerge from the shadows of the monorail and casino controversy to sparkle in its own light.

Joseph Conrad would have marvelled at this image of his beloved sea.

Client: Leighton Contractors for the Darling Harbour Authority

Architects: Philip Cox, Richardson and Taylor and Partners Pty Ltd

Structural engineers: Ove Arup and Partners Pty Ltd

Steel fabricator: Alico Steel, Newcastle

Builder: K.B.Hutcherson Pty Ltd (carpark) Barclay Brothers Ltd

Estimated cost: $80 million (for building)

Project start: July 1985

Estimated project completion: September 1987

A

B

C

A, B and C:
The Exhibition Centre under construction. The Exhibition floor is divided into five main halls. The roof over each hall is a tension structure spanning 80m with the supporting masts and tie downs external to the exhibition space. The roof loading applied to each mast is balanced by a tie on the opposite side which is attached to a ground anchored foundation. The appearance of the steel work is enhanced by high grade paint systems providing coatings of 120 microns thickness to the steel.

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PAPER 6

THE ROOF OF THE DARLING HARBOUR EXHIBITION CENTRE

by

MR B O'HEA

DIRECTOR

OVE ARUP & PARTNERS

THE ROOF OF THE DARLING HARBOUR EXHIBITION CENTRE

The Darling Harbour Exhibition Centre is one of a number of major buildings commissioned by the New South Wales government for Australia's bicentennial celebrations in 1988. The structural design was required to respond to architectural aesthetic requirements as well as facilitating fabrication and erection processes so that the tight construction programme could be met.

The design brief required that 25,000 square metres of exhibition space be provided with minimum interference from columns. In addition a main foyer was to be provided as an entry to the exhibition levels. Lounges, administration areas, plant rooms and parking for approximately one thousand cars were also required. The design which evolved situated the car parking at the lowest level on grade with the exhibition floor suspended above it (Fig. 1). The exhibition floor is devided into five halls of dimensions 80 m x 60 m.

The roof over each hall is a tension structure spanning 80 m with the supporting masts and tie-downs external to the exhibition space.

Between adjoining halls an independent structure comprising a south light truss and a suspension bridge provides support for moveable walls which permit the halls to be partitioned off from each other. Service pods support the ends of the south light trusses and suspension bridges as well as housing plant and equipment.

At the eastern ends of the halls lounges are situated at basement level from which the exhibition level may be overlooked. At this level at the northern and southern ends of the building offices are situated for administration of the Exhibition Centre.

In order to meet the very tight programme for completion of the building, 'fast track' management techniques were used to overlap the design and construction phases. The project was packaged into separate contracts for:

- foundations and concrete structure to hall floor level
- steel supply
- steelwork fabrication and erection
- services, finishes and fitout

This is illustrated in Figure 2.

Situated on the foreshores of Sydney Harbour, the site is underlain by Hawkesbury sandstone weathered to varying depths. In some areas unweathered sandstone occurs above site formation level. In other areas up to 20 metres of low quality uncompacted fill covers the sandstone.

Steel masts from which the suspension system are hung rise from the hall floor slab. Tie-downs for the suspension systems are anchored to tension piles which are in turn tied into the sandstone with permanent ground anchors (Fig. 3).

At roof level a grillage of tubular steel trusses triangular in cross section span between the pick up points of the suspension system. Also at this level outriggers attached to the mast enable the sloping external suspension members to change direction to vertical for attachment to the tension piles (Fig. 4).

Members in the suspension systems are fabricated from circular rod section with pinned connections to provide angular tolerance during erection and to permit rotation as loads are applied. Turnbuckles are incorporated in some of the suspension rod assemblies to permit adjustment during erection.

DESIGN

(a) Loads: The roof grillage, masts and suspension system have been subject to various load combinations to determine the most critical forces in the structural elements.

These load combinations are based on the following components:

Self weight of roof grillage, purlins and sheeting	0.55 kPa
Services	0.25 kPa
Live load	0.25 kPa
Hail load	0.25 kPa
Wind Load - in accordance with AS 1170 - Part 2 for 50 year wind in Category 3 terrain.	0.60 kPa

(b) Analysis: Analysis was carried out in three stages:

1: Two-dimensional linear analysis with simplified modelling of masts and roof grillage components

2: Three-dimensional linear analysis with explicit modelling of masts and roof grillage components

3: Three-dimensional non-linear analysis.

1. Two dimensional linear analysis: Several structural systems were analysed to this extent in the preliminary design phase to enable architectural appraisal and costing to be carried out. Three-dimensional effects were calculated manually. Since it was necessary to place an order for the bulk of the steel before design development was complete, the ordering schedule was prepared on the basis of this analysis.

2. Three-dimensional linear analysis: Due to the small amount of redundancy in the structure the three-dimensional analysis gave very little refinement to the information obtained from the two-dimensional analysis. However, it did enable the deformation pattern of the structure to be established for the different load conditions more readily. It also enabled differential thermal effects in the roof grillage and suspension rods to be examined.

3. Three-dimensional non-linear analysis: The linear analyses neglect two aspects of the behaviour of this structure which

have an impact on the design of some of the structural elements.

These are:

1) The axial stiffness of the non-vertical rods in the suspension system varies due to the different applied tensile loads. This is due to the rods sagging under their self-weight, this sag reducing in a non-linear manner under increasing axial load. In fact, even the vertical rods which behave linearly under varying tensile loads have zero axial stiffness when subject to axial compression. This is illustrated in Figure 5.

11) The axial tensile loads in the suspension rods are balanced by axial compression loads in the roof grillage, outriggers and masts. In addition wind loads induce horizontal forces in the plane of the roof. On the roof grillage in particular the effect that these axial loads have is dependent upon the vertical deflection of the roof grillage. This effect commonly known as $P\Delta$ effect, is also non-linear. Figure 6 illustrates this effect.

The non linear analysis is an incremental analysis which adjusts the geometry of the structure to include deformations from the previous load increment. This analysis was carried out using an in-house non-linear finite-element program on a DEC 10 computer.

Connections in the suspension system were analysed by finite element methods to ensure that the load transfer from cheek plates to pins could take place without unacceptable stress concentrations.

An analysis was carried out to attempt to establish the natural frequency of the roof and to identify the likely response to oscillating loads which may be applied to the roof. This was difficult to determine due to the non linear behaviour of the structure referred to previously. However, a natural frequency 1 - 2 Hertz was determined which is comfortably clear of the vortex shedding and gusting frequencies of the 50 year wind.

FIRE SAFETY

The structural requirements for fire safety as stated in Ordinance 70 were considered inappropriate for a building of this size and nature. The Department of Local Government agreed to review a submission by the designers which would demonstrate how the intent of the fire regulations was to be met in this building.

Specialist advice was obtained on likely fire load, egress times and structural performance of materials in the building and a 'Fire Protection and Life Safety Plan' was prepared. It has been possible to justify for this building a lower level of fire protection for the structure than an unqualified application of the fire regulations would permit.

O'HEA/4

FABRICATION DETAILS

The tension structure and roof grillage have been fabricated from tube rod and plate of grades 250 and 350 steel. These elements form a major part of the architectural treatment of the building both internally and externally. The Architect, Philip Cox Richardson Taylor & Partners Pty Ltd, chose the forms of the various components to reflect as accurately as possible their structural functions.

The masts are of 'diamond' cross form with circular tubes connected by double plate webs. The roof grillage comprises triangulated trusses triangular also in cross-section, and the outriggers are tapering vertically from centre to ends with horizontal rods contributing to their lateral stability under compressive loading.

A great deal of attention has been given by the Architect to the detailing of connections and this has been followed through to the final fabrication of components to ensure that the standard of brass finished appearance is commensurate with the visual importance of the structure. Complex profiling of the ends of tubular members was carried out to provide a clean appearance at these nodes. Welds which are evident in the final structure have been ground to enhance their appearance and the pin connections in the suspension system have been proportioned to visual as well as structural requirements.

The appearance of the steelwork has been further enhanced by high grade paint systems providing coatings of some 220 microns thickness to the steel.

ERECTION

The design documentation included a suggested erection procedure for the masts, tension structure and roof grillage which involved the use of two cranes and some temporary guys for stability. The contractor accepted this sequence with some minor modifications. Instead of temporary guys for stability they chose to erect temporary supports under the roof grillage. The erection was carried out using only two mobile cranes. The sequence is illustrated in Figure 7.

The roof levels are set using turnbuckles provided in various suspension rod assemblies. Since the roof moves downwards through some 400 mm as the load increases from roof grillage self-weight to its full design load, subsequent level checks are carried out after the roof sheeting and insulation is laid. To compare the levels from one survey to the next it is necessary to correct for temperature variations in the steelwork.

TESTING

A conservative approach was taken in the design and fabrication of the masts and suspension system components in view of the potentially disastrous effects of a failure.

Prototype testing of an end connector and turnbuckle assembly was carried out prior to commencing fabrication of the final assemblies.

O'HEA/5

Ultrasonic testing was carried out on all full strength butt welds in the masts and suspension rods and the major suspension rod assemblies were proof loaded to 1.5 x working load prior to being certified for installation in the structure.

Other steelwork in the structure was subject to more usual extents of quality control sampling and testing.

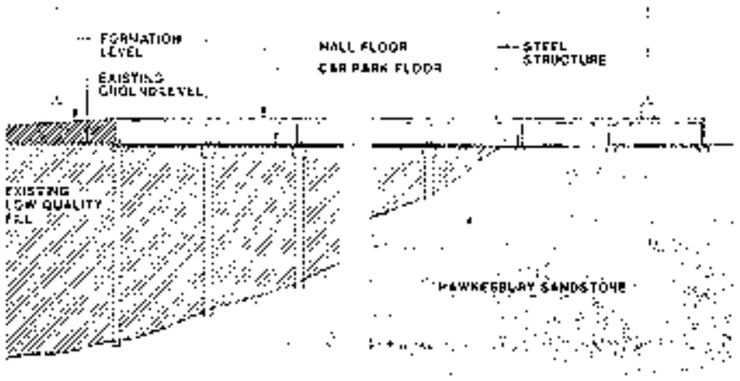
Ground anchors forming the tie-down foundation for the suspension system were also subjected to rigorous testing. These permanent anchors are fully encapsulated in corrugated polyethylene sheaths and were restressed at one day and thirty days after initial stressing to ensure that the load was being maintained before final grouting.

The design of this building was commissioned in April 1985. Employing 'fast-track' design and construction management the roof progressed from concept to erection complete in a period of only 20 months. The combination of aesthetics and rapid construction has promoted a great deal of public interest and support for the efforts of the Darling Harbour Authority to transform one of Sydney's eyesores into an area of elegance and international appeal.

O'HEA/6

FIGURES

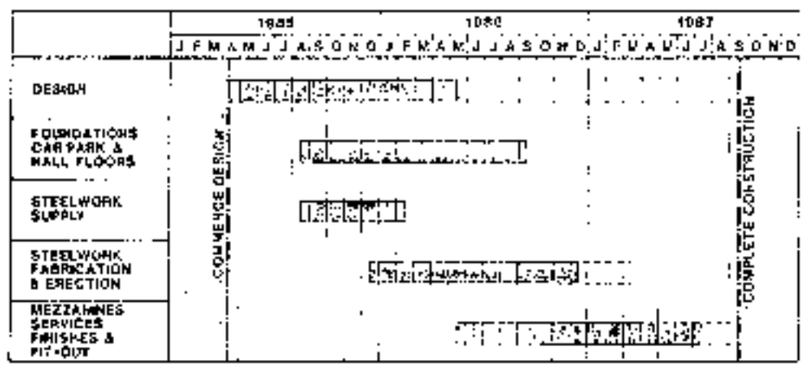
O'HEA/7



FOUNDATION & SUB-STRUCTURE

DARLING HARBOUR - EXHIBITION CENTRE

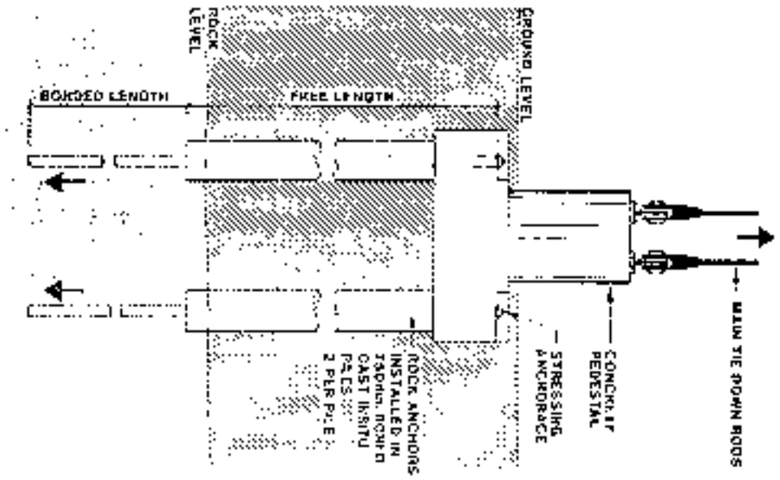
Figure 1



DESIGN & CONSTRUCTION PROGRAMME

DARLING HARBOUR - EXHIBITION CENTRE

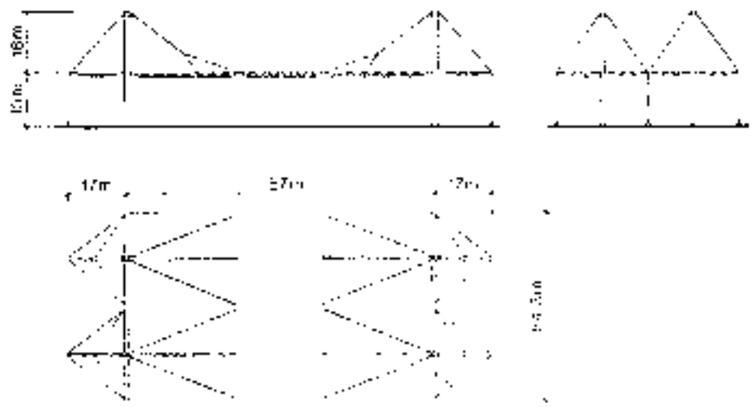
Figure 2



TENSION FOUNDATION

DARLING HARBOUR - EXHIBITION CENTRE

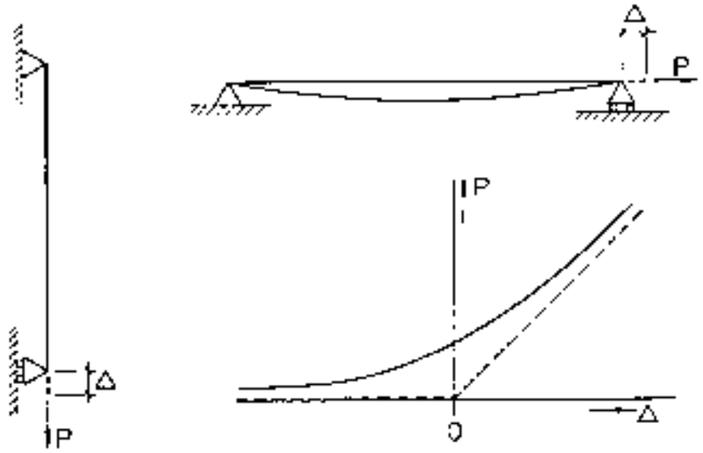
Figure 3



SUSPENSION SYSTEM

DARLING HARBOUR - EXHIBITION CENTRE

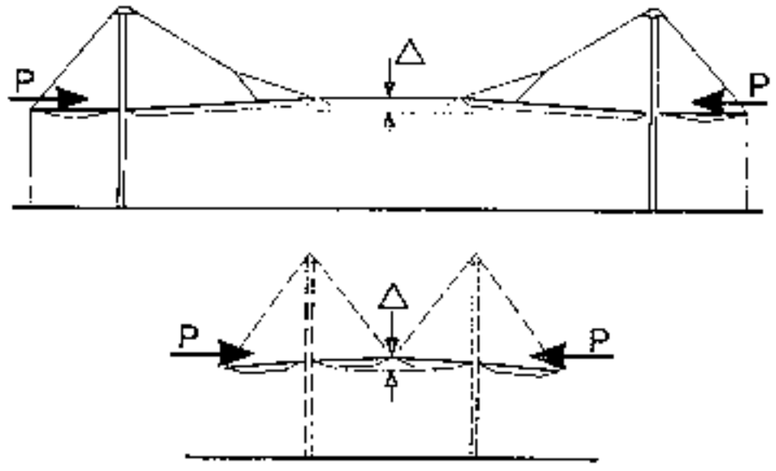
Figure 4



NON LINEAR EFFECTS DUE TO SELF WEIGHT OF NON-VERTICAL SUSPENSION RODS

DARLING HARBOUR - EXHIBITION CENTRE

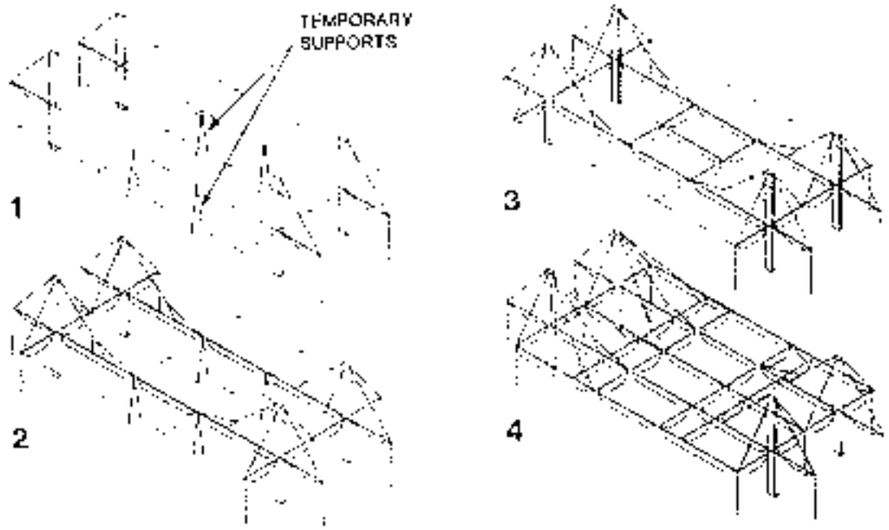
Figure 5



NON LINEAR EFFECTS DUE TO AXIAL LOADS IN CAMBERED ROOF GRILLAGE

DARLING HARBOUR - EXHIBITION CENTRE

Figure 6



ERECTION SEQUENCE

DARLING HARBOUR - EXHIBITION CENTRE

Figure 7

PAPER 7

THE APPLICATION OF STATE-OF-THE-ART TECHNIQUES IN THE DESIGN AND ANALYSIS OF A LARGE ELEVATED STEEL SILO

by

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DIRECTOR
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SILO/1

White Steel

The sports building works of Philip Cox, from 1977 and their global influence

Stuart Harrison

While COX Architects & Planners (COX) has grown into a multi-city and international practice of many collaborators, this essay will look at the COX 'manner' and language developed by founder Philip Cox through the sports and events projects of the firm in the latter part of the twentieth century. This is a story that starts in Canberra with the National Athletics Stadium and becomes a successful and influential approach for major sports buildings, perhaps best demonstrated by the Sydney Football Stadium of 1988. This path also reveals a strong interest in an Australian 'functional tradition' of construction, structural innovation such as the emerging 'high tech' work in England, the tensile experimental buildings of Frei Otto, and a tradition of structural expression in Australian architecture. Of particular interest is the practice's 'white stadia expressionism', which, after 1988, is adopted by other architects and becomes influential in the design of international sports facilities. This approach was epitomised by the use of expressed-steel masts, bracing and tensile cables for both structural efficiency and as part of an emerging design language, a language that embraces 'complete' stadia - as opposed to separated stands. It was part of a global move toward all-seat facilities, the need for uninterrupted views and the desire to shelter spectators.

The first use of expressed structural masts and cables by Cox was in Bruce, Canberra, at the National Athletics Stadium (now Canberra Stadium) in 1977 where the practice took onboard the efficiency and practicality of tensile structures, and rendered them in steel – both for structure and cladding. The use of steel cables enabled the suspension of the canopy roof without any internal supports to interrupt seating or views. Bruce stadium embraced a radical sense of tension, the masts angled and caught in a suspended moment between cables connected to the ground and those of the canopy. Tensile structures have a history in Australia, particularly through the exceptional 1959 Sidney Myer Music Bowl, Melbourne, designed by Yuncken Freeman with Bill Irwin as engineer – regarded as one of the seminal early structures in the world of its kind. Expression of structure and tensile cables can also be seen on the former Melbourne Olympic Swimming Pool, 1956, a great work of innovation designed by Peter McIntyre and Kevin Borland, again with structural engineering by Bill Irwin. It is this lineage that the National Athletics Stadium entered and developed upon.

The Bruce stadium was perhaps a transition from the more rustic 'Sydney School' palette of Cox's early work, exemplified by the 1965 C.B. Alexander Agricultural College in Tocal, New South Wales. The main hall and tower at Tocal demonstrate an early engagement with structural expression – in this case through timber. The chapel at Tocal features a large timber joint which joins over 400 shear-connector rings and was the first of its kind in the world[i]. Even though Tocal has a particular rural vernacular, the use of structural expression internally is overt –Philip Cox attributes this to large rural buildings such as the Cooling Towers in Kuri Kuri, New South Wales.[ii] The expression of structure for Bruce stadium 'comes outside' in contrast to the internal expression at Tocal. The Kambah Health Centre, 1973, also features an internal expression of structure, with a large central timber truss creating an open-span working environment.

The Bruce stadium was considerably extended in the 1990s when it was converted from an athletics venue to a more general-purpose stadium, home now to Canberra's rugby teams and a rectangular pitch. The original black and white photographs of this exceptional project show the stadium's careful integration into the bushy landscape of the Canberra suburb of Bruce. Indeed, it was Cox's sensitivity to landscape, through such projects as Tocal, that led to the Bruce Stadium commission by the National Capital Development Commission. Having never produced a sports building before, but with a strong interest in structure, this project was in many ways a major break for Cox and his practice and led to the sporting and large span projects that now dominate the COX portfolio. Another key project is the Australian Institute of Sport (AIS) Arena, immediately next door to the former athletics stadium on the AIS campus in Bruce. Completed in 1981, this fully-enclosed sports and general-purpose arena uses one of the most original and innovative roof systems ever seen in Australia. Slung precast concrete slabs form the roof, which are supported by high strength grouped steel cables. The externalisation of structure finds full force in this exceptional building.

The key engineering principle here is to maximise the weight of the roof to ensure the cables are always in tension rather than flipping into compression in an uplift situation, for which more substantial solid steel members would be needed. A finer network of cables, using less material, is then possible. Cox himself suggests this in part came from an observation of certain thatched Irish cottages, in which ropes are cast across the thatch with stone weights at their ends. The roof of the Bruce stadium, although thin and with a floating appearance, is also concrete for the same reason. The result in both cases is finely poised and taut system, a moment of balance.

In the early work of the practice, structural engineering design was carried out by the office, with checking and certification completed by a third party. This not only shows a strong interest in structural engineering, but an ability to calculate and optimise structural design; Cox recalls using a large beam compass when working out structural sizings for the Bruce stadium in a pre-computing environment. The early work at Tocal was the first major exploration of structural expression, in local timber, acting in tension and compression. This was an architecture of 'rude timber', one directly connected

to an Australian vernacular tradition rather than an interest in more refined and imported Georgian models. The sports architecture that Cox developed was thus perhaps one of 'rude steel' – where innovation in structural expression was built from Australian-made steel, simply and effectively connected.

Historically, Richard Rogers used expressed 'flying' cables and masts for the first time with Fleetguard Factory in France (1979-81) – after Bruce stadium – following limited expression of bracing while working with Norman Foster in the early 1970s. Frei Otto had a long-standing interest in efficient tensile structures, and first used expressed tensile cables on a large scale in the remarkable 1972 Olympic Stadium in Munich. Cox does not emulate Otto – whose language is more organic – but converts the structural possibilities into a readily understood and conventional construction environment.

As a successful architect of large buildings, he drew initial inspiration from the big vernacular buildings in rural Australia generally associated with primary industry. The wheat silos, large sheds and cooling towers that dot the Australian landscape provided a typological tradition to enter into. The study of Australian vernacular, made through Philip Cox's early writings on the subject in the 1960s and 70s[iii], crystallised how an honest expression of structure can lead to a building language that brings the structural and architectural disciplines together. This approach enjoys a material efficiency and enduring quality, as opposed to a more façade or image-based technique, which generally re-emerges in the 1970s and 80s. It is through the 'event' projects of the office that the theme of both evident structure drawn from the vernacular and of constraint-based experimentation develops.

Perhaps the most important project in the mid-career work of COX Architects & Planners is the Sydney Football Stadium. A Bicentennial project, this stadium uses repetition of a common element in a fluid and sinuous manner to create a work that, 20 years on, is still contemporary. It was a project which adopted the early use of digital techniques to describe and document a form that does not conform to traditional elevation-based composition. This general move toward computing was well suited to the large repetition-based projects coming into the office in 1980s. The repetition at the Sydney Football Stadium is three-dimensional, with masts being both arrayed in plan and with varying heights. The complex roof edge and lighting fascia around the inside of the stadium describe the outcome of this process and form a remarkably fluid loop. In this way the project represents a giant leap forward in stadium design. The iconic nature of the project is also created by the restraint of the white palette, perhaps more dominant here than anywhere else. The three-dimensional web of steel members acting in a combination of compression and tension is forged into a complex but clear expression to the exterior of the building, one which is vivid in its whiteness. Indeed, all of the projects completed at this time move toward extensive use of white painted steel. Philip Cox said this in relation to this use of white for the steel:

> *With the steelwork seen against the sky the main impression is it should be seen as more of a web rather than a heavy form. White is slightly reflective and gives almost a mystic quality, rather than if you painted in black or dark. You will read [these colours] in much more of an explicit way than you will if it's white, which tends to smudge the structure in a visual sense against the light blue Australian sky.*[iv]

There are many other possible readings into the use of white – the vernacular 'purified' and made 'modern' like the white avant-garde of interwar European Modernism; the colour of sailing; the legacy of Utzon and the Opera House; the dark ironwork of the nineteenth century bridges and train stations made new; an inversion of Mies Van Der Rohe's obsession with black steel in big buildings; or, a homage to the white-painted steel of his seminal Farnsworth House.

Another 'white' Bicentennial project, the Sydney Exhibition Centre at Darling Harbour, pushes its expressed structural masts into the public space at the front of the building, recalling the AIS Arena in Canberra. Being next to water, analogies to white ships' masts are hard to avoid, and Philip Cox himself welcomed these at the time. The fine white steel masts are indeed akin to modern white sailing boats, and in this way the language 'comes home' with the Exhibition Building at Darling Harbour. The other buildings by COX at Darling Harbour – the Maritime Museum and Aquarium – also abound with water-based comparisons – sails and waves typically.

The Exhibition Centre is a series of repeated halls offset from each other to establish a bay structure and avoid a completely continuous form. The perimeter space between the concrete cable anchor and the building itself forms a kind of minimal colonnade, in which users are partly within the structure. The historical precedent for work of exhibition and expressed frame is normally regarding as Joseph Paxton's famous Crystal Palace of 1851, where new materials and the desire to internally display numerous, and often large, objects forced a new kind of building, one which was part super-cathedral and part grand-train-station. Indeed, the Sydney Exhibition Centre carries the same belief in structure and need to satisfy a contemporary problem. The use of minimal structure in steel has both its economic and sustainable benefits, and became part of the enduring image of the celebratory function of the Bicentennial and of exhibition.

Sydney and Canberra are not the only sites of influence for sports and exhibition work. One of the major works completed for the 1988 Bicentennial was the National Tennis Centre, Melbourne (now Rod Laver Arena). The building embraces the wrapping nature of a stadium and creates a significant arcade around its perimeter, formed through a series of structural concrete arches, and capped with a continuous expressed upper level and endless ribbon window. The building's presence on the skyline of Melbourne is formed through the white steel truss of the sliding roof, also its primary technical innovation. This has been an enduring figure in the psyche of Melbourne for 20 years; the roof opening to sun and closing to rain is a Melbourne tradition. The Princess Theatre (1886) had a retractable roof, and more recently, the Docklands Stadium does the same on a larger scale, drawing from Rod Laver Arena in its expression of the roof truss system. Rod Laver Arena is a project that through its semi-radial nature has gained a civic role in its setting of Melbourne Park and the southern edge of the city.

The trend in covered stadia with operable roofs has developed considerably since the Rod Laver Arena. One of the largest in the world is the Millennium Stadium in Cardiff, Wales. Completed in 1999-2000 and designed by HOK + Lobb Partnership, this work shows the influence of Rod Laver Arena in the use of large white steel corner-masts and a wrapping ribbon window around the perimeter (enlarged to suit the bigger arena). Interestingly, the building that was replaced by Millennium Stadium – the National Stadium designed in 1962 by Osborne V Webb and Partners – used an expressed concrete and steel structure in which the cantilevered roof was supported by an expressed-steel truss fixed back to massive concrete fin columns. Another seminal sports building in the UK was the Crystal Palace National Athletics Stadium, London, completed in 1964 and designed by Sir Leslie Martin. This used angled steel masts and rigid steel struts to support a cantilevered roof. This project bears similarities to the Bruce stadium in both program and structural approach.

The success in large 'all-round' buildings rendered in expressive white steel informed the work of other small COX projects such as the 1994 Arena Joondalup, in northern suburban Perth. This is a multi-function sports and community building, locating a football and cricket oval on its eastern side. The latter's partial stadium, or pavilion, recalls the stadium at Bruce which engages the surrounding landscape through earthworks. This 'stand' is the end of a white linear building with halls and pool inside, and shows two types cleverly merged together. Several other Perth projects are interesting in the development of an architectural language - the Rio Tinto Research and Development Facility, and Joondalup and Stirling Train stations, all completed in 1993. The Stirling Station successfully translates the designs developed for COX's sports building into a train and bus interchange in the centre of Perth's Mitchell Freeway. Designed by Steve Woodland and Keat Tan of the now defunct Forbes & Fitzhardinge (later absorbed by COX Architects & Planners) it developed a clear structural system that avoids the 'heaviness' of many traditional rail and bus stations. The Joondalup train station introduced a curved-roof profile supported by cables, allowing light to enter a submerged train platform. A remarkably similar approach was taken for the main entry and circulation space for the Rio Tinto facility. Projects such as these represented the emergence of 'style', one removed from the need for large spans or uninterrupted views. In crossing typologies, the ideas grounded in stadia design had become a language.

This language has been 'exported' both through its influence on other firms and directly through several international commissions, particularly in Asia. The 1999 Singapore Expo building and 1998 Asian Games Stadium and Aquatic Centre, Bangkok, are two 'white' projects in the region that in many ways seem like Australian COX buildings expressed in different contemporary contexts.

The concentration of attention on Australia and Australian national identity in the late 1980s was driven by the Bicentennial and was a major opportunity for COX's work to be seen on a large scale, both through television coverage and the publication of the projects internationally. Key among this was the use of three COX projects in the revised 1991 edition of Dennis Sharp's book *Twentieth Century Architecture: a Visual History*. This European-published text assisted in making COX's 'white steel' work influential around the world. Sir Bannister Fletcher's *A History of Architecture* featured both the Bruce stadium and the Sydney Football Stadium in its twentieth edition (1996), bringing the works into one of the most well-known architectural texts of all time. The Bicentennial also brought cultural attention to Australia; the October 1988 edition of the London-based *Architectural Review* was an 'Australia' special, with articles on COX, Canberra, New Parliament House, Expo 88, Rex Addison, Edmond and Corrigan, Contemporary Aboriginal Architecture, Burgess' Brambuk Living Cultural Centre, Glenn Murcutt's 'Touch this earth lightly' and more. Jennifer Taylor's article 'Philip Cox's Bicentennial Buildings for Sydney' features the Sydney Football Stadium, the Sydney Exhibition Centre and National Tennis Centre extensively, but also both the key buildings at Bruce, completed up to 10 years earlier. Taylor also featured the Bruce stadium in her book *Australian Architecture Since 1960*, published by the RAIA in 1990.

Perhaps the most interesting manifestation of a national architecture is that of the 1988 Australian Pavilion in Venice used for the various arts (and architecture) biennales since. An often-criticised project, this small white steel building is unique in a garden setting of various classical, and some exceptional modernist, national pavilions. Part-Australian 'tin shed' and part-miniature

event building, it is an appropriate record of Australia's architectural development in the late twentieth century.

The influence of COX's white work of the late 1980s can be seen in sports stadia around the world in the 1990s. The 1994 Hong Kong Stadium by HOK is such a project, with a symmetrical white roof and flying structure. Similarly, the 1992 Johannesburg Stadium, designed by engineering firm Arup can be seen as a white version of the Bruce stadium. Like many successful 'big building' architects, COX formed a strong relationship with the office of Arup in the 1980s, which led to them moving into the same building in 1986. While not all COX projects are engineered by Arup, all the key Sydney 1988 projects feature Arup as the structural engineer.

Australia's most well known building, the Sydney Opera House, is a pinnacle of the architect-engineer collaboration – the design is a result of Jorn Utzon and Ove Arup working together as an architect-engineer figure. Like the nearby National Maritime Museum, the Opera House has had trouble escaping the comparison to boat sails and waves. There is an important distinction, however, between this work and that of COX; while the Opera House is more of a cave, COX's style clearly leans towards that of the tent – lightweight, optimised, clear in its structure and perhaps an acknowledgement of the temporary nature of occupation. The strongest work in the substantial COX portfolio follows this line. The 2002 WA Maritime Museum, Fremantle, edges more toward representation – an abstracted fish is used here and the approach is less successful, as it moves away from a reworked vernacular and functional tradition, towards the referential.

Following the Bicentennial, the next major international focus on Australia was the 2000 Sydney Olympics, for which many facilities were commissioned, particularly at the Olympic site of Homebush in western Sydney, a former abattoir. Sydney Olympic Park now features four COX event buildings, and after Darling Harbour, is central to the practice's work in this area. The COX projects include the site masterplan, the International Athletics Stadium, the Aquatic Centre, the Sydney Superdome (for indoor sports) and the relocated Showgrounds. With the exception of the master plan, all were completed in collaboration with other local architects. The principal stadium, Stadium Australia, designed by Bligh Lobb Sports Architecture, carries the influence of the COX manner in its design, particularly through the use of white exposed steel trusses. COX's own scheme for Stadium Australia literally heightened the expression of structure, with two symmetrical giant framework arches with steel webbing underneath supporting the canopy roof. In many ways it bears similarities to Norman Foster's Wembley Stadium, designed some years later and possibly the most well known sports project to employ a white-steel flying-arch structure large enough to be 'iconic'. The Khalifa Stadium by COX with PTW and GHD, used for the 2006 Asian Games, also shows the ongoing interest in the system developed for the main Sydney Olympic stadium.

The Sydney International Athletics Stadium, 1993, was the first project at the Sydney Homebush Olympic site. Here, the light towers are also giant structural masts from which cables supporting the canopy are suspended. The interest in efficiency creates a logical desire to merge the light tower and structural mast, and this can be seen in various COX projects since. The Sydney Showgrounds, relocated to the Homebush site as part of the redevelopment, also feature principal masts acting as light towers. Interestingly, the towers here are red rather than white, perhaps suggesting difference to the other buildings at Homebush. Cables are employed from both mast to roof, and roof to ground to resolve uplift forces – a different solution to the 'heavy roof' system explored in early projects. This further reduces the net quantity of material required, but does result in some visible cables within the seating area.

The Olympic Stadium for the 2004 Athens Olympic Games uses another large white-steel web structure – designed by Spanish architect Santiago Calatrava, known for his white and gothic-like structures, often transport buildings and bridges. His work contains a large degree of geometrical emphasis, and perhaps less of the functional tradition seen in COX's work. The 2008 Olympic Stadium in Beijing by Herzog and De Meuron shows another direction in global sports architecture, one which turns away from the COX tradition of expressed structure towards the expression of surface – often both structure and skin. Along with Herzog and de Meuron's exceptional *Allianz Arena* in Munich, such stadia represent an explicit move away from the growing universality of the expressed structure. While this interest continues for many, the work of COX Architects & Planners may now be aligning to such considerations. This is probably best seen in the new Melbourne Football Stadium, sitting alongside the seminal Melbourne Olympic Pool and National Tennis Centre. Essentially a series of optimised interlocking 'bubbles', this mid-capacity stadium uses EFTE cladding – all in white.

Whilst it is traditionally accepted that Glenn Murcutt has been a figure who has represented Australia overseas architecturally, it is clear that the work of Philip Cox and his practice has in fact been more influential at the level of large buildings, particularly those for sport and exhibition. Murcutt has made a highly successful and respected career from adopting the Miesian pavilion to regional concerns and identity but it is a model of adoption and one limited in size to domestic-scale projects.

COX proposes a different idea of a successful Australian architecture to that of the refined house in the landscape; instead these are big buildings and structures that resolve difficult issues and are mostly built in white painted steel. They are buildings that have tended to be built quickly and with modest budgets, and in this way have drawn on a pragmatic Australian tradition. COX has by and large avoided a historically referential language for sports buildings, partly due to the demands of cost and issues of span and visibility, and partly in recognition that many projects have been experiments in new typologies whereby constraints generate innovation. It is also possible to argue that the repetitive or serial nature of Cox's large event projects create a civic presence for the buildings in the same way classical buildings rely on repetition to establish a public sensibility. The opportunity to work at the scale of event facilities and stadia has allowed Cox to develop an influential Australian architecture that is not limited to the individual house, and embraces repetition, large spans and structure.

Stuart Harrison

[i] Established in an interview conducted by Stuart Harrison and Anna Johnson with Philip Cox, 20th March 2008
[ii] Cox Architects, *Cox Architects*, The Images Publishing Group, Victoria, 2000
[iii] In Philip Cox's books such as *Rude Timber Buildings In Australia*, 1969 (with Max Freeland and Wes Stacey), *The Australian Homestead* in 1972 and *Australian Colonial Architecture* in 1978.
[iv] From an interview conducted by Stuart Harrison and Anna Johnson with Philip Cox, 20th March 2008

Sydney's Bicentennial Birthday Present!

The Darling Harbour redevelopment scheme is one of the most exciting and important projects in Sydney this century.
It ranks in scale with the opening of the Sydney Harbour Bridge in 1932 and the completion of the Opera House in 1973. Scheduled for completion in 1988, the development of Darling Harbour will be a magnificent bi-centennial birthday present for New South Wales.
With a potential private and public cost of over $1,000 million, Darling Harbour is one of the largest development projects ever undertaken in Australia.
It is also perhaps the most meticulously planned. Stretching over an area of six city blocks, from King Street, City to Ultimo Road, it represents the most co-ordinated attempt at urban renewal in the history of our city.
But Darling Harbour is not simply a grandiose and futuristic development scheme. Ultimately Darling Harbour is designed to be a place for people.
This will be a place for every resident of New South Wales to enjoy, as well as a major tourist attraction.

A New Park for Sydney

The Harbourside Park will be a major new urban park for Sydney covering over five hectares in area.
Like the famous Tivoli Gardens in Copenhagen, it will be a carefully landscaped park with special entertainment facilities.
Chief among these will be a small Open Air Performance area, capable of accommodating 2,000 people, it promises to be one of the most popular features of the Darling Harbour development.
Also planned for the park is a water organ – a set of fountains choreographed to lights and music. You won't believe just how good Bach's Toccata in D minor can look when played on the fountains.
A Carousel and Bandstand will also feature in the park.
Carefully designed pathways and plazas in the park will make for very pleasant walks and will be ideal for parades and processions.
In all, the Harbourside Park will be nearly as large as the southern half of Hyde Park. The western side of the park will be raised to the level of the exhibition centre and will feature continuously changing flower displays.

Bridge gets a Facelift

Many Sydneysiders were dismayed when Pyrmont Bridge was finally closed – after all, it's been a major link to the Western Suburbs ever since it was completed in 1902.
Soon people will be able to use this historic bridge again. But this time only as pedestrians.
Pyrmont Bridge is currently being given a facelift before being put back into service as a people's concourse.
Easy access around the Darling Harbour area and to the City is a feature of the development plan, and Pyrmont Bridge is an important part of the design.
It's a bridge of great historical significance, with a unique engineering design by an Australian engineer. The wooden truss structures and electrically operated swing mechanism make it a real rarity.
The pedestrian concourse will provide immediate access from the city side of the development to the Western foreshore and the National Maritime Museum. In addition, there will be a major pedestrian link running from the edge of Pyrmont Bridge right through to Market Street and the main shopping area of Sydney.
There aren't many Swing bridges still operating in the world today, so Pyrmont should prove a real attraction, especially when the restaurant on top of the swing section opens for business in the Bicentennial year – a Darling Harbour variation on the old revolving restaurant theme.

Our Seafaring History on Display

One of our most exciting projects in the Darling Harbour development is the formation of a National Maritime Museum.
Unlike the other publicly funded projects, this will be a Commonwealth Government facility which will house the nation's collection of maritime history, including historic ships, floating exhibits and every conceivable by-product of man's relationship with the sea.
The Sydney Maritime Museum will relocate from Birkenhead Point to Darling Harbour to form part of the new museum complex.
The National Maritime Museum was awarded to Sydney by the Commonwealth Government over the competing claims of other states.
In hindsight, Sydney was the logical choice and Darling Harbour the logical site. After all, Sydney has witnessed every facet of Australia's maritime growth, with Darling Harbour the headquarters of our first mercantile marine industry.

1. National Maritime Museum (in association with Sydney Seaport)
2. Pyrmont Bridge
3. Exhibition and Convention Centre
4. Exhibition Pavilions
5. Waterfront Promenade
6. Western Boulevarde
7. Rail Platform
8. People Mover
9. Harbourside Park
10. Outdoor Performance Area
11. Flower Garden Display
12. Water Organ
13. Band Stand
14. Carousel
15. Ornamental Lake
16. Lakeside Restaurant Pavilions

The Darling Harb

Features

Darling Harbour is a perfect example of public planning in harmony with private enterprise. There are over 20 publicly funded projects planned for the development, in conjunction with seven major private projects.
The public projects include a major new Exhibition and Convention Centre with separate glass exhibition pavilions, a new national maritime museum, a Harbourside Park covering more than five hectares, an outdoor performance area, and a Chinese landscape garden to link the Darling Harbour development with Chinatown.
Private projects include Harbourside

bour Development

Restaurants and Retail Markets, commercial office sites, an International Village featuring the culture and cuisine of our Pacific and Asian neighbours, and a major new international hotel in one of Sydney's premier locations.
It's hard to believe that all of this will be located in the same area, with easy walking access between developments and to the rest of the city!
And it's more difficult to comprehend that such a wonderful recreational facility will be located in Darling Harbour – for years the dead end of Sydney.

17. Darling Walk
18. Chinese Landscaped Garden
19. Ferry Wharf
20. Site for Proposed National Aquarium
21. Day Parking Marina
22. Markets 1 & 2 Development Site
23. Charter Boat Wharf
24. Harbourside Restaurants and Retail Markets
25. Commercial Office Sites
26. Multi level Car Park with roof gardens over
27. International Hotel
28. International Village
29. Motel and Car Park
30. The Swing Bridge Restaurant

Darling Harbour History

The first mention of what later was to be known as Darling Harbour is found as early as 1788, under the name of Long Cove.

In the early days of the infant colony there was little trade with the outside world: American ships traded items in short supply and British ships brought convicts. But as trade picked up, Cockle Bay, as Darling Harbour was now called, began to accommodate the overflow of shipping from Sydney Cove.

In the 1820's wharves were built to receive produce from Parramatta and Windsor, and a new steam driven mill established.

By the 1830's, commerce was continuing to grow. Cockle Bay became Darling Harbour and its importance to the colony was already established.

New wharves to handle the increased coastal trade were built in the 1840's. New mills were built and a gasworks established to bring lighting to the streets and wharves in the area.

In the 1850's, a rail link was established and Darling Harbour continued to prosper.

The trade and importance of Darling Harbour grew in the following decades as the rail links throughout the state were extended. By 1888, Darling Harbour was linked by rail as far-afield as Albury, Hay, Jerilderie, Bourke, Mudgee, Narrabri and Glen Innes, and received all kinds of agricultural produce from these country centres.

At this time, the absence of a goods railway to Circular Quay meant that cargo ships had practically deserted Sydney Cove for Darling Harbour.

The 1890's saw the introduction of new technology – hydraulic power – which was used to press the bales of wool at the wharfside and also enabled the old steam cranes to be replaced.

At the same time, the new Pyrmont Bridge was built – a swing bridge of world class which operated electrically. Electricity itself was being generated nearby at the Ultimo Power Station to provide power for Sydney's electric trams.

The city markets were relocated in the Darling Harbour area, close to the railway facilities, shortly before the First World War.

But the end of the First World War saw the final demise of the old Iron Wharf and the need for an even larger railway yard.

During the depression, many firms in the area closed for good. And as the direct link between rail and shipping facilities grew less important with the development of container terminals, and their concomitant road transport, the closure of the railway yard became inevitable.

Darling Harbour, once a bustling prosperous centre, had become obsolete.

Major Convention Centre

The State Exhibition and Convention Centre will fill a big gap in the provision of meeting facilities when it opens in 1988.

Until now only Sydney's major hotels have been able to offer high class convention facilities, and even then usually only with a limited capacity.

But the new Exhibition Centre will be the biggest and most complete centre of its type in Australia and the South Pacific, allowing Sydney to host just about any major international or business conference.

The Centre will have 30,000 square metres of exhibition space and will be able to host meetings of up to 3,500 delegates. If required, they could host conferences in conjunction with the Entertainment Centre, taking the capacity up to 12,000 delegates.

Special overhead links will give easy access between the two centres.

In addition, the Darling Harbour Authority is building two extra glass-walled exhibition pavilions underneath the freeway. These futuristic pavilions will be multi-purpose exhibition sites, allowing business groups or government bodies to stage anything from formal displays to informal social gatherings.

The glass walls give a superb view of the waterfront on one side and the Harbourside Park on the other.

Naturally the State Exhibition and Convention Centre will be used in conjunction with the exhibition pavilions to house the NSW Bicentennial Exhibition – the major event in the State's 1988 celebrations.

Our Sister Lends a Hand

You may not be aware of it, but New South Wales has a sister-state relationship with Guandong Province in China.

It's a link that will prove very useful in the years leading up to 1988.

Already the Chinese have generously offered to help with the Darling Harbour development by assisting in the design of a traditional Chinese landscape garden, adjacent to the Harbourside Park.

The landscape garden architects of Guandong are world famous, and the garden promises to be a highlight of the Darling Harbour development.

The Baltimore Connection

Planners of the visionary scheme to transform the entire Darling Harbour area into a major tourist and recreational centre have studied closely an enterprising overseas planning approach.

It comes from the city of Baltimore.

Over the past 20 years, Baltimore has completely redeveloped its inner harbour in one of America's great urban renewal projects.

Once dockside Baltimore was a place few dared to venture, even in broad daylight. Now it attracts over 20 million tourists a year.

Like the Darling Harbour scheme, the Baltimore project was a joint venture between government and private enterprise. They combined to produce a business, community and leisure showplace out of a seedy, neglected part of the city.

The 40-odd attractions in Baltimore's world famous Inner Harbour draw more visitors in a year than even Disney World. It's an area packed with fascinating shops, great restaurants and unusual amusements.

The development has not only revived a dying section of the American waterfront, but also created enormous revenues for the city and significantly boosted the local economy.

Two American architects who worked on the Baltimore project have visited Australia this year and studied the plans for the Darling Harbour development project. Both James Rouse and Martin Millspaugh were impressed by the similarities between Sydney's Darling Harbour and Baltimore's Inner Harbour, and by the obvious potential of the Australian project.

What The Press Say

If all the plans for redevelopment around Sydney Harbour come to fruition, it's going to be the most amazing place by the time we celebrate Australia's Bicentenary.
Mirror Editorial – March 30, 1984

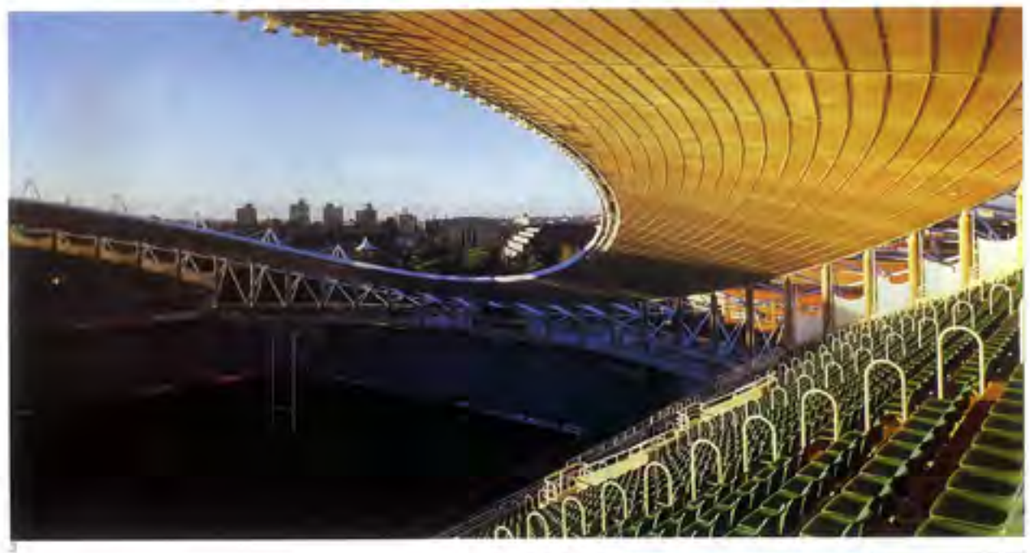
Darling Harbour is the most exciting community development project undertaken in Australia this century.
Telegraph – March 30, 1984

The project would create about 3000 permanent, part or full time jobs.
Mark Coulton – *Sydney Morning Herald* – October 13, 1984

Darling Harbour offers "an unsurpassed potential to create the kind of people space" which has been so successful in Baltimore.
Martin Millspaugh – Quoted in *Daily Mirror* by Ian Skinner – April 3, 1984

“The Architectural Review”
October 1988

1
Shade structures, Yulara tourist village, 1988.
2
East elevation of Darling Harbour Exhibition Centre.
3
Roof of Sydney Football Stadium as seen from upper level.
4
General view of stadium grandstand and field from middle level.



Jennifer Taylor

Philip Cox's Bicentennial Buildings for Sydney

The year Philip Cox has produced two major steel structures for Australia's second centennial celebrations. In attempting a particularly Australian approach to such structures, Cox transcends mundane structural and architectural concerns to achieve a memorable imagery of romantic celebrations of place and region as well as of function.

Throughout history the creation of architecture has derived from mastering technology to mould the artistic vision in space and form. During this century this essential of the creative act has come dangerously close to being undermined. Philip Cox's recent steel buildings are imaginative works of arresting configuration fashioned for visual potency and delight. In this way they belong to the tradition of Expressionist architecture stretching back to Utzon and Saarinen and beyond. On the other hand, they are technically expressive, rejoicing in the bravado of structural exploits. In this sense they are rooted in the iron and steel technology of the nineteenth century. It was exactly the potential for imagery, due to advances in technology, that underpinned the early phantasmic dreams for the coming Utopia of the twentieth century. The lessons were already there last century with the now fabled structures that were great achievements as much for their memorable forms and uplifting spaces as their advanced engineering. But, as the decades ticked by, their lessons were set aside to be but spasmodically revived in such works as Frei Otto's fabric structures. As the twentieth century draws to a close it is enlightening to look back and see the triumph of the Rationalist use of advanced structures. While the Rational view of a world of steel and glass grew strong and survived, the poetics of Mies' dreams of the '20s faded and the Romantic visions of Taut and Mendelsohn were all but forgotten. Perhaps it is unacceptable to dream in the last Utopia of today.

In 1988 Philip Cox has produced five major steel designs that bring together fact and fantasy and deploy technology to serve the creation of images such as appropriate for function and place: the roofs of the Sydney Football Stadium and the centre court of the National Tennis Centre in Melbourne (with Peddle Thorp & Learmonth), and the Exhibition Centre, the National Maritime Museum and the Sydney Aquarium, all in the Darling Harbour Development, Sydney. Completed in Sydney are the Exhibition Building and the Football Stadium. The inventive gymnastics of the steel structures in Sydney come from the close relationship established between the engineers Ove Arup & Partners[1] and the Philip Cox, Richardson & Taylor office.[2] This association was solidified in 1986 when they jointly bought and occupied a central city building, facilitating collaboration at all stages of design.

This steel architecture is not a celebration of structural itself, nor even of architecture. It is not based on a mechanistic analogy such as one finds at Centre Pompidou nor does it elucidate the potential for the elegance and refinement of craftsmanship in technology as at the Hong Kong & Shanghai Bank. Rather, it concentrates on the architectural act of creativity involving places for enjoyment. Cox sees the Australian approach to structure as essentially floristic and quite contrary to the more Classical position of British architecture.

Philip Cox has always been a painter of images and a maker of places. Interested in Australian architectural history, influenced by the Australian Romantic landscape school of painters, he has tirelessly argued for an appropriate regional definition for design. With this has been his insistence on the integrity of materials in architectural expression. These tenets, combined with a deep-seated love for the land, gave rise in his early career to delicately timed, brick and timber buildings that blended with their settings. These earth-bound buildings culminate in

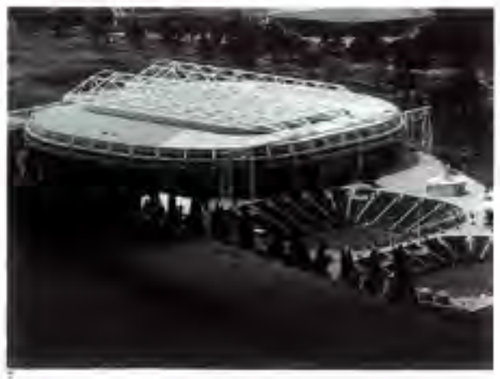
culminate in the Yulara lounge village, Ayers Rock, Central Australia, 1984 (AR March 1985 pp46-49) where the colours used are ochres, dirty pinks, dark reds and salty greens of the desert landscape. But at Yulara, counterpoised against the heavy thermal masses of the buildings, are tensile fabric shade structures that dance like huge kites over the rooftops, introducing the first fanciful flights in Cox's architecture.

The major building that marks the transition from small-scale, masonry buildings to large-scale tensile structures precedes Yulara by seven years. The National Athletics Stadium at Bruce, near Canberra, clearly shows Cox's initial attempt to handle a large building in sympathy with its setting. The cantilevered, backstayed canopy projects freely over the stone-faced stand that merges with the earth-bermed seating arena melded with the land forms. The Bruce Stadium is an evident precursor to the dynamic scenario of the Sydney Football Stadium in the steep pitch of the tanned seating of the grandstand, the relationship of roof to seating, and the freedom of its structural gesture.

The indoor sports centre, Cox's first wide-span indoor structure, followed the open stadium on the adjacent site. It is cut four metres into the ground with the earth banked up around it on all sides. The entrance is at mid-level. This is a more muscular and prosaic building with a precast concrete panel roof on 100 metres long triangular cable trusses backstayed to anchors. Work here provided the experience for the National Tennis Centre[3] and the Exhibition Building.

Exhibition Building, Darling Harbour

Sydney's major Bicentennial project, the Darling Harbour Development, is the site of three of Cox's 1988 steel structures. The Darling Harbour Project is a highly ambitious, government backed, transformation of a derelict 54 hectare harbour-front site into an inner city entertainment centre. The flat site, bounded to the east by the commercial and retail core, and to the west by a visually strong wall of nineteenth-century woolstores that Cox affectionately calls brick palaces, is cruelly slashed across by the raised distributor of the freeway system. The waterway is interrupted by the old Pyrmont Bridge now rendered incongruously impotent and debased to serve foot traffic and support the piers of the new monorail system. Adding to the difficulties of planting Darling Harbour, was the pressure exerted by the government to complete the project by 1988, leaving little time for reasoned thoughts as to what should be built; where it should be placed; the overall

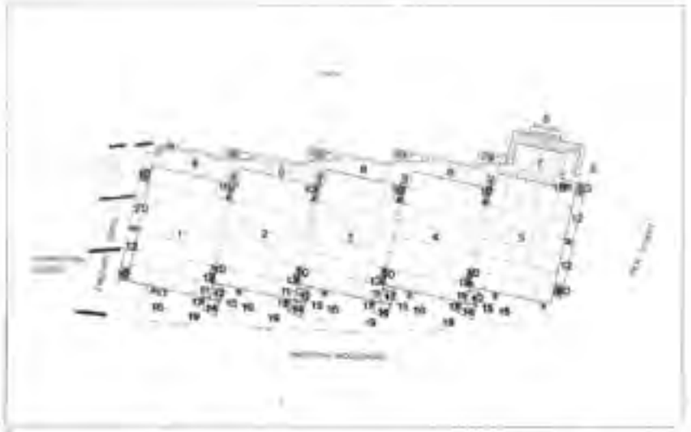


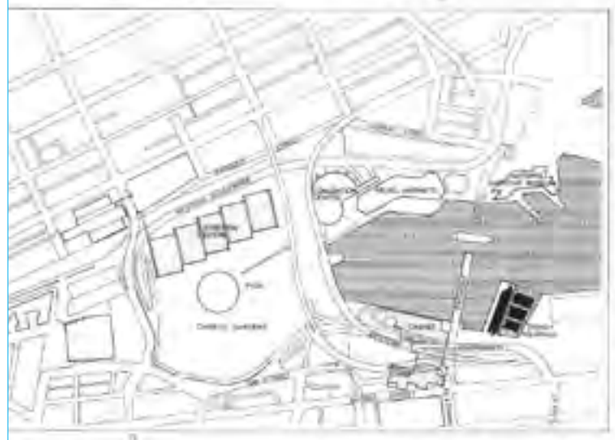
5
Sydney Athletics Stadium, Bruce, 1977

6
Indoor sports centre, Rhyde, 1981

7
Centre court at National Tennis Centre, Melbourne

Philip Cox's Bicentennial buildings



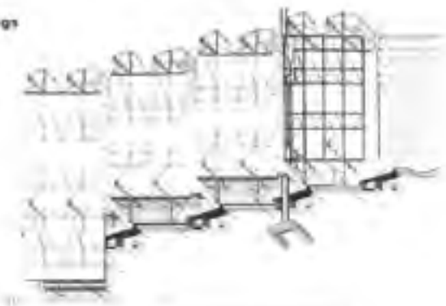


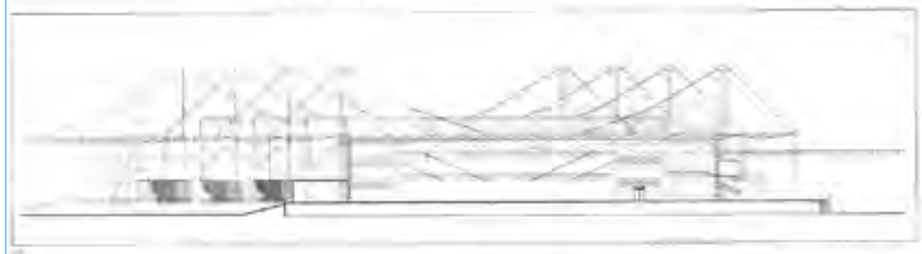
planning within the site; and the project's relationship to the surrounding city. The kinship of Cox's three buildings helps bring some coherence to this scene.

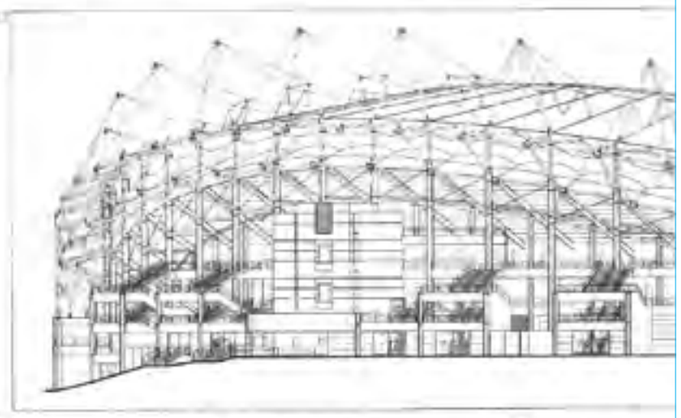
Debatable was the decision to include such a large Exhibition Centre of five halls, each of 5000 m², on this inner city site, but in the final plan it takes its place along the western edge with John Andrews' Convention Centre (to which it is linked), a glazed market building and the National Maritime Museum. Given the size and scale differentials arising from 84.60 m column free halls and general clearance heights of 13.5 m, Cox has done well to produce a lively building that impresses by the artistacy and variety achieved within an orderly modular structural discipline.

Conscious of the expectation for exhibition halls to take steps forward in technology, and with reference to their architectural aesthetic from the Crystal Palace to I. M. Pei's New York Exhibition and Convention Centre, Cox chose an expressive steel structure. The flamboyant, exposed, mast and cable system ultimately selected not only provides a festive note, but successfully links the building with the masts of the tall rigged ships by the adjacent harbour front. The decorative aspects of this structure are exploited. The masts rhythmically puncture the air, and, like Gothic pinnacles, break up the mass of the building with a linear screen which also establishes a dialogue with the backdrop of the handsome brick walls of the woolstore facades. While this structure clearly derives from Rogers' Inmos Centre and Foster's Renault Centre (AR December 1982 and July 1983) with regard to span requirements and setting, it appears more purposeful here. Primarily it is, however, the staggered relationship of the five halls that makes this a rich and eventful building, presenting total, but ever-changing views of the facades. This arrangement gives individual identity to each hall but still allows the total complex to operate as a unit. Alternating grey and white horizontal panelling wrapped around and over the building adds to the gift box appearance of the enclosed volumes. Isozaki's banding of the NEC building, 1980, is recalled, but while Isozaki's building is solid and severe, Cox's building is power-weight and light-hearted.

The section provides further clues to the complementary resolution of the planning logic and facade treatment. Parking is at ground level under the building. By dividing the plan longitudinally into three zones, the exhibitions are conveniently located along the western wall, near to the delivery zone, while the extensive glass-enclosed public foyers line the eastern wall outside the enclosed and projected exhibition spaces, contributing to the vitality of the most public face of the building. A terraced through-fare delivered by cantilevers, awnings, stairs, balustrades, flagpoles and so on is provided at mezzanine level allowing the passer-by to look

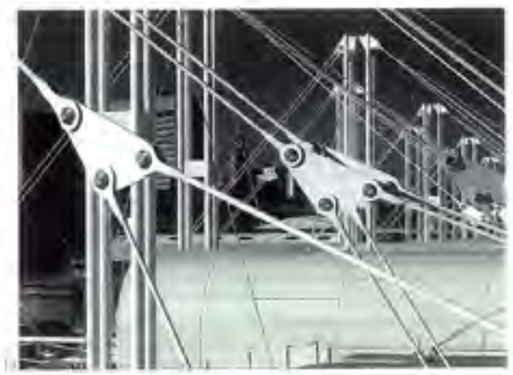






down on the activity inside. This concourse also permits Cox to introduce minor ancillary rooms, such as lounges overlooking the park, which further subdivide the large surfaces of the main halls. What threatened to be a vast, multi-spatial container has been given highly active expression over which decreasing sized units are laid to bring a familiar scale to the whole.

But the Exhibition Hall also fulfils an important role on the harbour site as the apex of the triangle joining the yet incomplete National Maritime Museum and the Sydney Aquarium. Since the Exhibition Hall, Cox's steel structures have become more expressionistic. The architects' 1986 report on the National Maritime Museum commented: 'The architecture . . . requires a lyrical, even theatrical, expression based on nautical themes for it to be identified with the sea'. It has been interesting to observe that, in terms of form, the Sydney Opera House has had little impact on Australian architecture for 30 years, but Utzon's conceptual drawings unquestionably provided the inspiration for the Museum and the Sydney Aquarium. The mental connection is easily made and is appropriate, linking the buildings on Sydney's inner-harbour waterfront. The Museum and Aquarium are podium buildings above which float sinuous wave-like roofs visually attuned to their harbour-side setting. Of the billowing roof of the Museum, Cox has said 'I wanted it to look like a boat in full sail about to float down the harbour – I really wanted to be as corny as that!' Like the Opera House, Cox's three Darling Harbour buildings are viewed as often from above as from the ground and the fifth facade was considered as important as any other. In both buildings the roof structure is diagonally sliced through in places, wilfully asserting the dominance of form over structure, while revealing the rational geometry of the section. The Maritime Museum and the considerably smaller Aquarium roof elements, bowing to each other across the water gateway to Darling Harbour. Their free forms mark the



transition from the commercial port to the lookend of the cove and connect the city with the harbour.

The Museum is a deceptively large building with a clear height in its major hall of 25 m. Towards the harbour it opens up to the peristrome through glass walls protected by 4·5 m overhangs. Once again Cox has controlled the scale, here by curving and layering the roofs so that they appear to flow down towards the harbour, bringing their eaves close to the pedestrian. The Aquarium was constructed on a concrete slab poured on an existing pier, its curving roofs form a shell for a series of display spaces related in a thematic and spatial sequence that extends to two large tank Oceanariums semi-submerged in the harbour and moored to the pier.[4]

The language of the glass and panelled skin established in the Exhibition Building continues in the wrapping envelopes of their steel frames (vertical all-white in the Museum and horizontal green and white in the Aquarium).

14
Perspective of National Maritime Museum, Darling Harbour (building)

Sydney Football Stadium

The great roller-coaster of the Sydney Football Stadium is the *prima de résistance* of Cox's structural acrobatics. Sited on the old Sydney Sports Ground field next to the Sydney Cricket Ground and the Royal Australian Showground, in a residential area already harassed by cars, crowds and arc lights, this proposal to build was met with considerable resistance. Cox's response was to design a swirling fun-fair building. The cantilevered steel roof structure is spectacular, supported on a tubular steel triangulated space-frame truss. Concerned with scale, Cox pulled the northern rim of the roof down in salute to the residences and the major traffic route that lie to that side. The corresponding southern point was also dipped in a token gesture to the weather conditions that threaten from that

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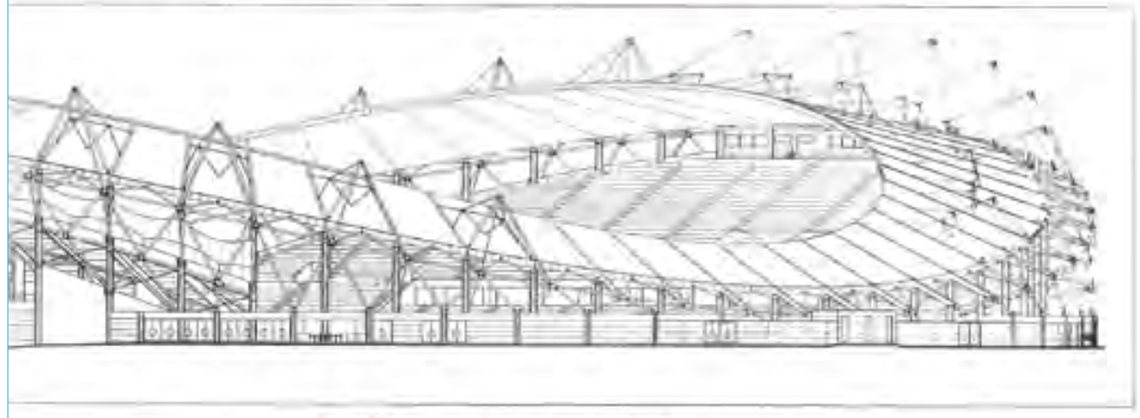

direction.[5] The rectangular playing field runs north-south so the roof sweeps up and out to the east and west over the grandstands located where viewing is optimal. Wind-breaking bands of taut folded fabric wrap like great scarves around high sections between the roof and the walls, adding to the mad celebratory air of the building.

As the roof sweeps up and dips down it defines a space unified and continuous and never static. As in the National Athletics Stadium, the brick-faced concrete seating area (for 38 500 spectators) is solid and heavy, creating a great stooped-out base for the wild white steel bonnet perched on top. The building peers out from under its bonnet with the somewhat stunned expression of a dowager bewildered by her own audacity. More poetically, Cox sees the roof as a parasol or a white cloud floating above the earthiness of the base. Despite little connection between the roof and the walls, the forms create a powerful sense of enclosure. The playing field is submerged three metres below the natural ground level

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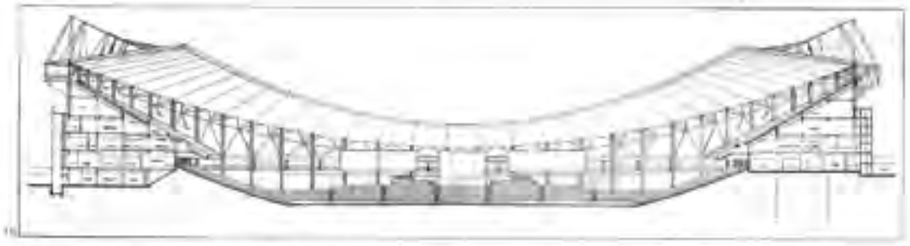
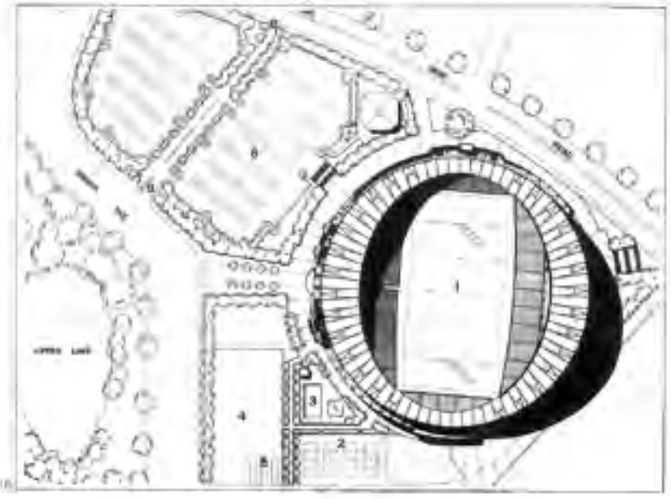


increasing this sense of containment. With seating at playing level only eight metres from the sidelines up to (at the top of the 30 degree angle grandstands) 30 m above, providing virtually aerial views, the relationship of player to spectator is dramatic.

This amphitheatre rejects the stability of its Roman precedents; rather, with the lack of consonance between its inner and outer plans, it is intensely Baroque. From on the field there is a strong centripetal force arising from the true circular geometry of the stadium's perimeter which counters the longitudinal pull of the playing area and the elliptical opening in the roof overhead. There is something exhilarating in the dash and motion of the place. The movement in the roof, while experienced from everywhere in the stadium, is most demanding from the upper seating where the sky and fragments of the city are framed within the undulations of the oval-cut void over the arena. Cox was seeking a building that would thrill and awe. Its essence lies in the reinforcement of the exhilarating experience of the game through the excitement of place and occasion that it offers.



essential-arc

Essential Architecture-

Steel construction Jonathan Ochshorn

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The shed. The use of steel for long-span roof structures has its roots in 19th-century bridges, train sheds, market halls, and exhibition spaces. Structures like the Crystal Palace (1851) in London and the Galerie des Machines (1889) in Paris already showed the potential of iron (or steel, in the case of the Galerie). New functions requiring long-span roofs evolved in the 20th century, including hangars for airships and aircraft as well as single-level factories oriented towards the new flexible assembly-line production techniques pioneered in the automobile industry.

Paxton, Crystal Palace under construction

Ouvré, Galerie des Machines

Long-span steel trusses, originating with 19th-century bridges (Benjamin Baker's steel truss Forth Bridge in Scotland was the world's longest spanning structure at the time of its completion in 1890) were used in numerous factories and other building types to create large, column-free interior spaces. Albert Kahn's Glenn Martin Aircraft Plant (1937) in Middle River, Maryland, is of interest not only because its 300-foot (91 m) trusses created the largest flat-roof span attempted up to that time but because Mies van der Rohe used a photograph of its interior to construct his famous collaged image for a Concert Hall project, published in 1943. Additional representative examples in which steel parallel-chord, horizontal trusses are featured as important architectural elements include the New Haven Veterans Memorial Coliseum (1972) by Kevin Roche and John Dinkeloo, where exposed corrosion-resistant steel trusses carry a multilevel parking structure over the stadium below; and the McCormick Place Convention Center (1970) in Chicago by C.F. Murphy Associates, in which two perpendicular sets of parallel trusses are used. An unusual multistory application of long-span steel trusses can be seen at the Pompidou Center (1977) by Renzo Piano and Richard Rogers, where the truss span—and therefore the required depth of the structure—is reduced through the use of sophisticated cast steel "gerberettes" cantilevered inwards from

water-filled tubular steel columns to support the trusses, the columns being expressed on the building's exterior along with tensioned steel rods and diagonal cross-bracing.

A. Kahn: Glenn Martin Factory sectional views

Mies: Convert Hall College

Roche & Dinkeloo: Memorial Coliseum

C.F.Murphy: McCormick Place Convention Center

Piano & Rogers: Pompidou Center

Variations on steel trussed arches and frames, providing lightweight and structurally efficient spans, can be seen in early 20th-century hangars for airships (Zeppelins) and factory buildings, especially in Germany. An early example, influenced by the three-hinged steel arch forms of 19th-century bridge and exhibition structures, is Peter Behrens's AEG Turbine Factory (1909) in Berlin, in which hinges and vertical elements comprising the repetitive steel arches are expressed on the exterior of the side facade. Norman Foster's Sainsbury Centre (1977) in Norwich, England, uses tubular steel trussed rigid portal frames, which contain the mechanical services for the building while providing a clear span for the display and academic functions within. A more complex three-hinged trussed arch appears in Nicholas Grimshaw's Waterloo International Rail Terminal (1994) in London. There, the required asymmetry results in steel tension elements of the truss—expressed as thin rods—being located first above, then below the roof structure, creating a form at once rational and counter-intuitive. A final example is the International Exhibition Center (1996) in Leipzig by Ian Ritchie, in which arched trusses with cast-steel support arms form an exoskeleton supporting the vaulted Main Hall.

Behrens: AEG Turbine Factory

Foster: Sainsbury Center

Grimshaw: Waterloo Terminal

Ritchie: International Exhibition Center

Polyhedral-based structures—three-dimensional versions of simple planar trusses—were pioneered by Alexander Graham Bell in 1907, and developed into more sophisticated space-frames by Max Mengeringhausen in Germany in the 1940s and Konrad Wachsmann in the United States in the 1950s. Buckminster Fuller invented the geodesic dome, based on the triangulation of a spherical surface, in the late 1940s. Steel lamella roofs, consisting of intersecting, offset systems of parallel ribs, have been used in hangars, stadiums, and other long-span applications. Later 20th-century versions of these forms include the Javits Convention Center (1986) in New York City by I.M. Pei, consisting of a steel space frame used for both walls and roofs; Fuller's geodesic dome for the USA Pavilion (1967) at the Montreal Expo, and the steel lamella Louisiana Superdome (1975) by Sverdrup and Parcel Assoc.

Fuller: Geodesic Dome @ Montreal Expo

Pei: Javits Convention Center

Long-span masted tension structures, inspired by 19th-century suspension bridge and 20th-century cable-stayed designs, use steel rods in tension to support horizontal roof surfaces. The Burgo Paper Mill (1962) in Mantua, Italy, by Pier Luigi Nervi quite literally mirrors the form of conventional suspension bridges to create clear span spaces below its suspended roof. More recent masted steel structures exploit the same principles, although their forms have become less derivative of bridge design and more articulate in expressing the exposed steel connections between tension rod, horizontal beam, and vertical mast. Notable examples by Richard Rogers include the Fleetguard Distribution Center (1979) in Quimper, France; the Inmos Microprocessor Factory (1982) in South Wales; and the PA Technology Laboratories (1985) in Princeton, New Jersey. Norman Foster's Renault Distribution Center (1980) at Swindon, England, has a more complex geometry defined by perforated, tapered beams, masts, and tension rods. The Darling Harbour Exhibition Center (1988) in Sydney, Australia, by Philip Cox, Richardson and Taylor makes reference, in its masted supports and steel outriggers, to the adjacent maritime harbor and its associated nautical motifs. The suppression of tension elements and the elaboration of the mast into compressive "tree-like" structural forms—first systematically studied by Frei Otto—can be seen in several steel-framed projects by Santiago Calatrava, including the BCE Place Gallery (1992) in Toronto and the Oriente Station (1998) in Lisbon.


Nervi: Burgo Paper Mill


Rogers: Inmos Microprocessor Factory


Rogers: PA Technology Lab


Foster: Renault Distribution Center


Cox et al.: Darling Harbour Exhibition Centre


Calatrava: BCE Place Gallery

In tensioned-membrane structures, steel cables are combined with fabric membranes to create extremely light-weight, long-span structures. Frei Otto's tent structures for the German Pavilion (1967) at the Montreal Expo and for the Munich Olympics (1972) are landmarks in the development of these forms. Two late-20th-century long-span examples are the Georgia Dome (1992) in Atlanta, engineered by Weidlinger Associates and based on a patented "tensegrity" geometry defined by triangulated steel tension cables and floating steel compression struts, and the Millennium Dome (1999) by Richard Rogers in which the dome—historically a compressive structure—is transformed into a tensioned membrane by hanging the steel cable net defining its domical surface from an array of twelve inclined steel masts that penetrate the membrane. Light-weight domical surfaces can also be formed with membranes by mechanically increasing the interior air pressure, as in a balloon: an early example of such a pneumatic structure, contained by a net of steel cables, is the American Pavilion at the Osaka Expo (1970) by Davis Brody Associates.


Otto: Munich Olympics


Weidlinger: Georgia Dome


Rogers: Millenium Dome


Davis Brody: American Pavilion, Osaka

With the development of welded connections—first invented in the late 19th century, but not used in buildings until the 1920s— steel beams and frames could more readily be designed within the modernist syntax of interpenetrating line and surface, uninterrupted by gusset plates, bolts, or rivets. The buildings of Mies van der Rohe at IIT in Chicago illustrate this type of abstract welded steel expression, most dramatically in the exposed parallel portal frames of Crown Hall (1956). Later projects from the 1960s and 1970s, influenced by Mies' work, include Roche and Dinkeloo's Cummins Engine Company plant (1966) at Darlington, England; the Reliance Controls plant at Swindon, England (1966) by Team 4 (including Norman Foster and Richard Rogers); and Skidmore, Owings and Merrill's Republic Newspaper Plant (1971) at Columbus, Indiana. Functional requirements, for example the need for daylighting in the immense new factory buildings of the steel, automotive, and aircraft industries, could also be addressed using welded steel frames, angled or stepped to accommodate monitor skylights. Such bent frames can be found in Albert Kahn's Chrysler Half-Ton Truck Plant (1937) in Detroit and, more recently, in Helmut Jahn's Terminal One Complex for United Airlines (1987) in Chicago, the latter project utilizing clusters of tubular steel columns supporting perforated steel beams that define skylit, linear public circulation spaces within the terminal. Curved, welded ribbed frames are used at an even more monumental scale in Rafael Viñoly's Tokyo International Forum (1996), defining an immense elliptical tied-arch roof supported by two centrifugally-spun steel pipe columns 400 feet (124 m) apart.

[next section]


Mies: Crown Hall, IIT


Roche & Dinkeloo: Cummins Engine Plant


SOM: Republic Newspaper Plant


A. Kahn: Chrysler Half-Ton Truck Plant


Jahn: United Airlines Terminal


Viñoly: Tokyo International Forum

already appears in [illegible] Fitzroy Dearborn (Taylor and Francis)
Publishers

Sydney's Darling Harbor Exhibition Centre is a unique exposure of an elegant structure critical to the architect's concept, according to the judges who gave it the 1988 ACEA Award of Special Merit

ENGINEERING EXCELLENCE

Darling Harbor tops record 51 entries

Ove Arup & Partners has taken out the prestigious Award of Special Merit, in the 1988 ACEA Engineering Awards for its work on Sydney's Darling Harbor Exhibition Centre.

The winners and high commendations in the 7 categories were announced at an ACEA function in the Opera House on November 30. Hazel Hawke handed out the winning and highly commended certificates.

Altogether a record 51 entries were submitted from around Australia.

Members of this year's judging panel were Alex McLachlan (chairman), IEAust president and chairman of McLachlan Consultants; Len Stevens, head of the Department of Civil & Agricultural Engineering at Melbourne University; Dudley Wild, president of the Royal Australian Institute of Architects; and Peter Berents, president of Building Industry Specialist Contractors of Australia.

The panel's convenor was Eric Brier of consulting engineer Eric Brier & Associates.

The judges said the competition showed an impressive variety of consulting engineering skills.

They considered the Exhibition Centre as presenting a unique exposure of an elegant structure critical to the architect's concept.

"The cable stage structure reflects the image of ships, masts and cranage so familiar to the waterfront. In pure engineering terms the features worthy of the highest award are the provision of longspan column-free space, conformity with strict program and budget controls and constraints; the use of 3 dimensional non-linear analysis programs and details expressing their precise structural purpose."

The centre consists of five 5000m² halls. It is capable of functioning as a single space or as 5 smaller subdivisions.

The budget was established at $55 million and targeted for completion in September 1987.

It was officially opened by NSW Premier Nick Greiner last March.

The winner of the civil category is **Macdonald Wagner Pty Ltd** for the Callide B powerstation ash dam and evaporation ponds.

The powerstation is designed to be Australia's first zero- discharge powerstation. No wastewater is allowed to flow into the watertable as there are cotton, oil seed and sorghum industries in the district. To get the maximum rate of evaporation 143ha of wet ash storage ponds, 130ha of shallow terraced evaporation ponds and 8 small gully dams were constructed.

"The engineers have provided an excellent example to other power utilities and consultants in eliminating the risk of pollution from the discharge from the powerstation," the judges said.

Highly commended in the same category was **Crooks Michell Peacock Stewart Pty Ltd**, for the North Head sewage treatment plant in Sydney.

The winner of the structural category was **Maunsell & Partners Pty Ltd** for the National Tennis Centre, Melbourne.

The centre comprises a centre court stadium seating 15,000 spectators plus 2 match courts, further playing courts and an adminstrative complex.

So that the centre court can be used as a multifunction entertainment venue it is covered by a retractable roof.

Darling Harbour Exhibition Centre

...in the spirit of Paxton's Crystal Palace

"In pure engineering terms the features worthy of the ACEA's highest award are the provision of longspan column-free space, conformity with strict program and budget controls and constraints; the use of three-dimensional non-linear analysis programs and details expressing their precise structural purpose".

SPECIAL MERIT AWARD

Ove Arup and Partners

The judges of the ACEA's 1988 Engineering Awards decided to make the Award of Special Merit to Ove Arup and Partners for their outstanding entry of the Darling Harbour Exhibition Centre in Sydney.

They said the project, "presented a unique exposure of an elegant structure critical to the architect's concept and essential to the appeal and success of a public building".

The decision to build the cable-stayed structure at Darling Harbour was generated by three major criteria. Firstly, there was a need to provide large column-free spaces economically within the building and so it made sense to have the vertical support structure outside and above.

Secondly, the vertical mast and slim cable support enabled the mass of the structure to be broken down into an acceptable height, profile and articulation, more compatible with the scale of the historic buildings which surround it. In addition, visually it reinforced the image of ships' masts and cranage so familiar to the waterfront.

Thirdly, it recognised the speed and efficiency of the "meccano" approach to building employing "dry" construction methods. The highly repetitive structural forms fabricated off-site in a factory-type environment was the only way a building of such scale could be completed in time for the Bicentenary year.

The Centre consists of five identical halls each 5000 square metres with one hall upgraded for special exhibitions and banquets. The Centre can perform as a single space or be reduced to the five or even smaller subdivisions.

Ove Arup and Partners were appointed structural and geotechnical engineers for the project to, "provide a framework for a quality building in an environment that was a joy to experience for people of all ages." The building had to accommodate virtually any exhibition type including major national or international events, specialised exhibitions in arts, crafts, cultures or technology.

The Darling Harbour Exhibition Centre was the backdrop for the official opening of Darling Harbour by Her Majesty Queen Elizabeth in May 1988. Since then it has been the venue for several major exhibitions including the Skills Olympics 1988, First State '88 and The Sydney Bicentennial Fair. It has been seen and enjoyed by the eight million visitors who have walked through Darling Harbour since it was opened to the public.

Other Consulting Engineers

Mechanical Engineers: Bassett Consulting Engineers

Electrical Engineers: Addison Hogarth Wilson Pty Ltd

Hydraulic Engineers: Crouway Murray Pty Ltd

Client: Darling Harbour Authority

Architect: Philip Cox & Partners Pty Limited

Contractor: Leighton Contractors Pty Ltd

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Architect
Philip Cox, Richardson, Taylor & Partners
Client
Darling Harbour Authority
Consulting Engineers
Ove Arup & Partners — Structural, Civil, Geotechnical and Traffic

★ ACEA
Special Merit Award 1988
★ IEAust
Highly Commended — Building & Civil Design 1987
(Roof Structure)
★ IEAust Sydney Division
Winner — Building & Civil Design 1987
(Roof Structure)

Darling Harbour Exhibition Centre Sydney

The Exhibition Centre is a major component of the NSW Government's redevelopment of Darling Harbour waterfront and railyards.

The Centre is located in the south-western corner of the development with the Pyrmont Woolstores as a backdrop.

Five halls, each 5000 m^2 in area and slightly offset from each other, make up the centre which can operate as a single entity or subdivided into the five or smaller subdivisions.

The halls sit over a car park of similar area catering for 1000 cars, the wearing surface for which is laid directly onto prepared subgrade.

The exhibition floor is a reinforced concrete flat slab capable of supporting uniform loads of 20 kPa. The slab is supported by columns spaced to meet the car park layout with service penetrations through the floor based on a 6 m x 6 m exhibition grid. These conflicting grids are readily accommodated within the flat slab floor system.

The halls have a clear internal height of 12 m and have small mezzanine areas on the east and west sides which contain amenities. Suspension bridges across the halls link the mezzanine areas for pedestrian movement

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and to form support for the mobile division walls.

The metal deck is supported on a long span cable stayed structure divided into 85 m x 60 m areas, each supported on four columns located outside the hall area giving column free space inside.

The system adopted was the most economic given the spans concerned and is architecturally compatible with the image of masts and stays associated with the waterfront. It provided the shallowest roof depth and therefore minimal height impact.

The tension structure and roof grillage are fabricated from tube, rod and plate of grade 250 and 350 steel. As these elements form a major part of the architectural treatment of the building, the forms were chosen to accurately reflect their structural function.

The detailing of connections follows this philosophy, being proportioned to visual and structural requirements to ensure that the standard of their finished appearance is commensurate with the visual importance of the structure.

The superstructure is supported on piles driven through the alluvial subsoils to rock.

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Darling Harbour Exhibition Centre

RECNO/1 870714
PF/1 JOB ARTICLE
JN/1 3667
OFFICE/1 Sydney
TITLE/1 Darling Harbour Exhibition Centre.
CLIENT/1 Darling Harbour Authority
DATE/1 1986
AUTHOR/1 TUBEMAKERS OF AUSTRALIA LIMITED
DE/1 EXHIBITION STRUCTURES
DE/2 DARLING HARBOUR AUTHORITY
SOURCE/1 TUBELINE DESIGN 7 pp.4-7.
&

Client
Darling Harbour Authority
Location
Sydney, Australia
Architect
Philip Cox & Partners Pty Ltd
Structural Engineer
Ove Arup & Partners
Fabricator
Allco Steel Corp Pty Ltd
Managing Contractor
Leighton Contractors Pty Ltd

Scale Model

Australia's largest and most innovative Exhibition Centre is currently taking shape as part of the Darling Harbour Scheme in Sydney.

The scheme is a $1,500 million joint public and private sector project consisting of the Exhibition Centre, a Convention Centre, world class casino, five-star international hotel, harbour-side restaurant and retail complex, National Maritime Museum, major parklands and an ornamental Chinese garden.

The Exhibition Centre is the largest building on-site and will be used for several major Bicentennial celebrations during 1988.

Architects, Philip Cox & Partners Pty Ltd were appointed in March 1985 by managing contractors, Leighton Contractors to develop the design for the Exhibition Centre working with the Darling Harbour Authority's Project Design Directorate.

The final design was completed after consultation with John Andrews International, architect for the Convention Centre, to ensure the potential for combined functions and architectural complement between the two buildings would be optimised.

4

Foreword

An architect's role is to create a concept and make it work.

We have used tubular steel in many of the projects we have designed because it is a good material to work with and has so many interesting dimensions. Its slender and lightweight appearance gives it versatility, and its dimensional accuracy and closed section design give it an absolute advantage in a wide variety of uses.

On site I've seen the unsurpassable speed and efficiency of using steel in construction. Steel hollow sections in particular, with their ease of erection, handling and maintenance reinforce the economy of using steel.

This issue of Tubeline Design 7 demonstrates some of the innovative and striking uses of tubular steel. The Darling Harbour redevelopment, for example, is one of the significant projects currently under construction with which I am delighted to be involved.

In two major buildings in the Darling Harbour Bicentennial project — the Exhibition Centre which is featured in this issue and the National Maritime Museum — steel is used for superstructure and cladding. Steel will feature strongly in the architectural appearance of the complete project.

In the Exhibition Centre, steel produces a highly skeletal and lightweight appearance so important to reduce the impact of such a large building. The external steel cable and tubular mast structural system, clearly visible from many vantage points, is capable of economically spanning the 110 m width without the need for internal columns.

The design comprises masts and cables and sheer metal panel surfaces to symbolise tall ships, giving Darling Harbour its nautical atmosphere. The masts are currently being erected at a rate of about one per fortnight with the attachment of cables and tubular trusses following in a direct sequential operation — very efficient construction.

The National Maritime Museum requires a variety of space, size and shapes to accommodate vessels from 12 m yachts to small canoes, relics, memorabilia and other displays. Steel works well here because of its flexibility in producing these varying shapes while having a consistency of form throughout the building.

As with the Exhibition Centre, the Museum has a nautical expression of billowing sails, hulls and rolling waves. Tubular steel trusses of equivalent radius have been developed to create the curved forms and will be clad in a metal panel system, emphasising the curve.

One of the great benefits of specifying steel for these buildings is that we have been able to use steel for both structure and roof and wall cladding to produce a finely detailed and consistent expression without the complication of combining other materials.

Steel is an innovative material which has a definite and complementary place in all the projects outlined in this issue of Tubeline Design 7. In reading this, I hope you feel stimulated about tubular steel and its unlimited potential.

Sincerely,

Philip Cox

Philip Cox
Philip Cox and Partners
Architects

Design Criteria

Darling Harbour is an historic part of Sydney which close to the city, fronts onto the harbour and wharf areas, and is surrounded by freeway structures and the old Pyrmont wool stores.

All these visual relationships had to be considered in the final design to ensure the building would blend with its environment.

In addition, it had to complement the Convention Centre, provide a focus to the adjacent park landscape and waterways, and provide visual appeal because of its visibility from the city centre.

According to John Richardson from Philip Cox & Partners, the primary concern when designing the Centre was that it would blend with its unique surroundings and, simultaneously, address the practical considerations related to its function.

"We wanted the Centre to reflect the images of the masts and rigging of the tall ships that once crowded Darling Harbour. At the same time, we had to satisfy the design brief requiring a completely column-free Exhibition Centre with the capacity to house the largest possible exhibitions under one roof.

"Tubular steel was the most appropriate material to provide the structural design solution and works exceptionally well aesthetically. The chosen structure gives the Centre a celebrative and festive quality that is totally fitting for its purpose.

"Overall, it is the most appropriate design in terms of function, architecture and integration with the rest of the development."

The Design Concept

The eastern edge of the Exhibition Centre forms an enclosure around parklands. The glazed eastern facade is stepped back in five stages and spreads north to connect with the Convention Centre.

The extensive use of glass along the eastern elevation optimises the views from ground and elevated levels. Also the use of glass in combination with several different architectural treatments — awnings, cantilevers and stair masses — softens the structure and provides continuity between the park and exhibition halls.

Each stage of the Centre can be partitioned to form smaller exhibition halls with a system of linked foyers along the park frontage of the building and culminating in a major foyer at the southern end.

The halls are sized and serviced to accommodate virtually any exhibition type with a basic hall module size of 60 m x 84 m, subdivisible down to 3 m exhibition units. If required, the hall modules can be opened to produce one space approximately 300 m x 84 m.

The linear plan with a system of equivalent, independently serviced halls allows for:

- individual, self-contained halls with their own foyers, toilets, loading and exhibitor amenities;
- visual and partial acoustic separation and independent air conditioning;
- external 'pockets of space' for ancillary facilities; and
- a view from each hall of the adjacent parkland.

The linear arrangement also gives the capacity to link the Centre with other separate connection points — the Sydney Entertainment Centre and carparks to the south, the Convention Centre and carpark to the north, Pyrmont to the west and other Darling Harbour developments through the park to the east.

Location of the Exhibition Centre in the Darling Harbour Scheme

As many people will view the Centre from above, from the CBD and Pyrmont, an integrated roof and wall structure and cladding was developed. The roof is a suspended lightweight tension structure providing a column-free area of 84 m x 60 m for each hall and supported by four steel masts.

Peter Wallace, from Leighton Contractors believes the Centre's design is the most innovative ever seen in Australia for a building of this type.

"To provide 3.5 hectares of floor space under a 15 m ceiling without any vertical columns is a remarkable achievement. To do this with a design that still retains the feeling of the harbour is outstanding."

The Construction Phase

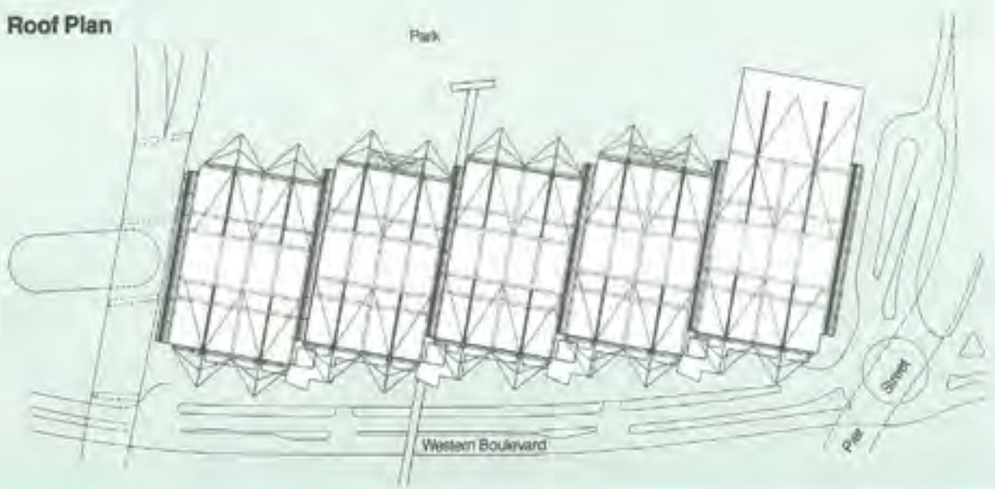
A total of 2,200 tonnes of tubular steel, approximately 60 kg/sq m, is used in the roof and supporting wall structure.

The centre roof has a cable-suspended trussed roof system supported by 20 steel masts 33 m long and consisting of 406 mm CHS tubular steel sections for each mast. The tension structure was designed by structural engineers, Ove Arup & Partners, using suspension rods and hangers.

Four tubular steel masts support the roof above each hall. Each column consists of four steel tubes held together by batten plates. Mild steel tension rods, placed in pairs, extend from the top of the masts to various pick-up points on the grillage of the trusses at roof level.

Roof support structure

Roof Plan



Roof loadings are applied eccentrically to each mast and balanced by a tie on the opposite side and attached to a ground anchored foundation. Wind loads are resisted by masts cantilevering from a piled foundation so that each hall structure is independently stable from adjoining walls and peripheral structures. The internally visible roof grillage consists of triangular steel trusses that resist the compression forces associated with the inclined tension rods.

The roof sheeting is carried on top of the roof grillage with the walls passing inside the line of the masts. The walls are made from metal sandwich panels consisting of two sheets of steel with insulation inside. They are all pre-fabricated and will be clipped together on-site.

All tubular steel used in the Centre is treated with the latest protective coating — epoxy primer, micaceous iron-oxide and a cosmetic white PVC-based paint that is recoatable urethane.

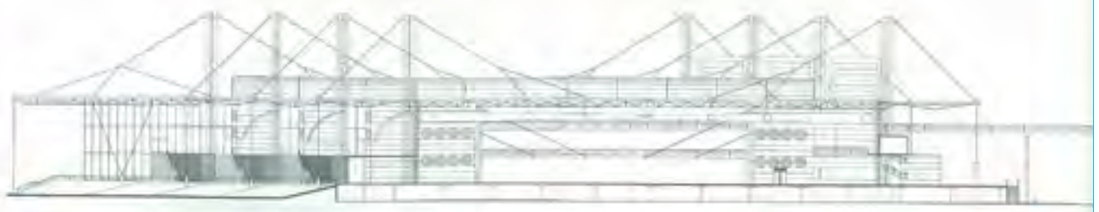
The exterior of the building uses the exposed masts, tension rods and tie-downs for architectural expression as well as structural considerations.

Site erection of the steelwork began in May 1986 with six main masts and approximately 20 trusses erected during June.

Construction is expected to be completed in late 1987 when preparations for the Centre's use during the Bicentennial celebrations will begin.

Steel masts (below) and in position (above)

Darling Harbour Exhibition Centre



Darling Harbour Exhibition Centre is conceived as the premier exhibition facility in Australia. The project is a major component of the NSW State Government and Darling Harbour Authority redevelopment of Darling Harbour and former railyards for the 1988 Australian Bicentenary.

The Centre is located on the western side of the development area against the backdrop of Pyrmont's woolstores. North and south boundaries are formed by the Western Distributor and Pier Street abutting Haymarket respectively. The eastern edge is formed by a recreational park.

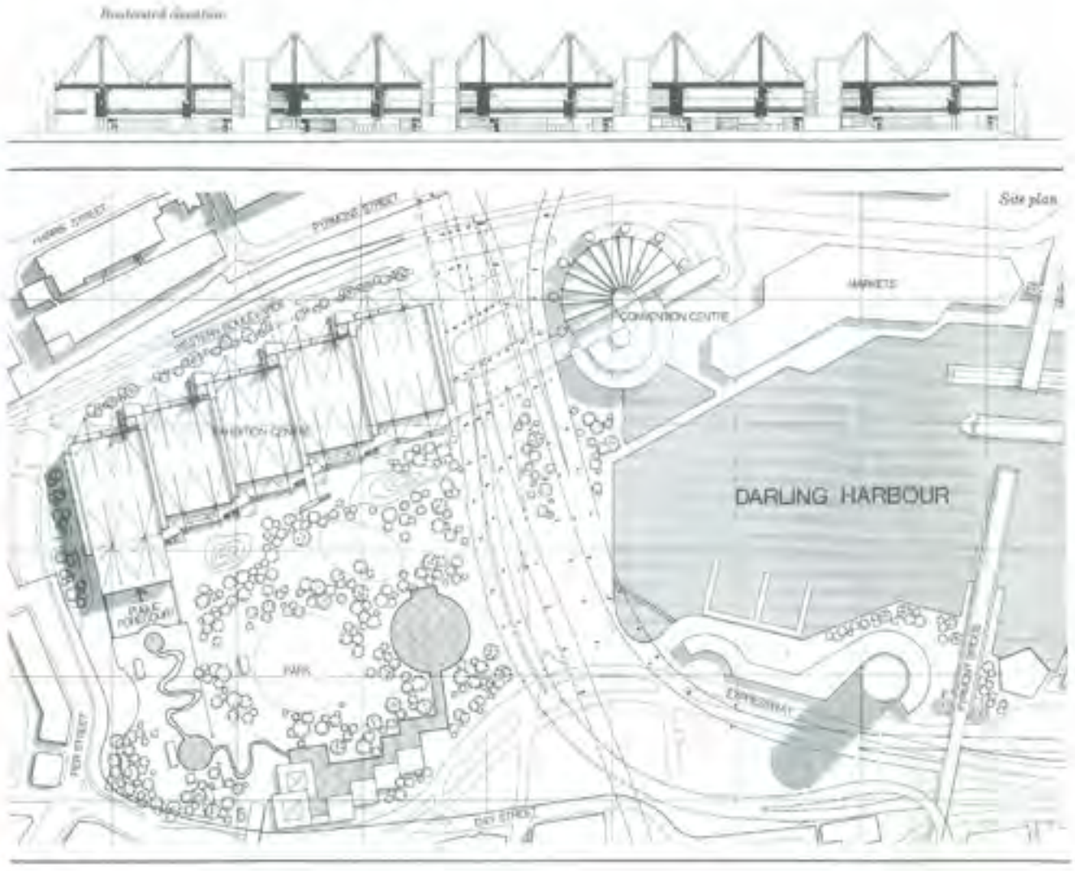
The plan encompasses five equivalent halls each of 5000 square metres with one hall upgraded for banquets, balls and special exhibitions. The Centre is capable of performing as a single space or subdivided into the five or smaller subdivisions as required. The general internal height is 15 metres with the special hall designed to accommodate a mezzanine level if required.

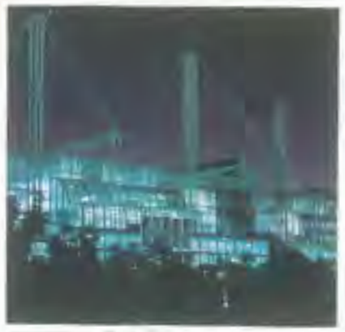
The Exhibition Centre and Convention Centre located to the north of the Western Distributor, are served by a single level carpark of 1000 car capacity located beneath the Exhibition Centre floor. A new main road, called the Western Boulevard, links this carpark with the Convention Centre, Markets and Pyrmont.

Pedestrian links are incorporated from Quarry Street and proposed railway station to the west, from the Convention Centre to the north, from Haymarket to the south and from a monorail system along the western boundary of the site.

Generally, the form of the building is linear with public facilities and foyers continuous along the eastern (Park) elevation, and exhibitor facilities and loading docks segregated along the western (Boulevard) elevation. The main entrance and foyer is located at the southern end off Pier Street from a public forecourt and vehicular drop-off zone.

The building's expression is derived from an elegant 'mast and cable' structure designed to reflect the nautical theme of Darling Harbour and from an extensive partially glazed wall taking advantage of views to Darling Harbour Park. The Park edge is conceived to be highly activated with ground and elevated public pedestrian systems.





Engineering features

Ove Arup in his Alfred Bossom Lecture to the Royal Society of Arts in 1970 said: 'What we build should always be a whole, an entity, and the job of giving it the wholeness is a work of art...'

The design of the Darling Harbour Exhibition Centre was conceived, developed and constructed in this spirit. In pure engineering terms the roof features worthy of the term 'excellence' are:

- the provision of long-span column-free space;
- the conformity with strict programme and budget constraints;
- the use of three dimensional non-linear analysis programmes written by the firm;
- details expressing their precise structural purpose;
- cable stayed systems.

Cable stayed systems comprising masts supporting the roof envelope by tensioned cables were considered the optimum solution for the following reasons:

- the system exposed the whole structure and was therefore an architectural element in itself;
- architecturally, the system was compatible with the image of masts and stays associated with the harbour;
- it was the least expensive solution and produced the most efficient use of material;
- it produced virtually column-free exhibition halls;
- it was suitable for the required spans and required uncomplicated junctions and details;
- it gave the shallowest roof depth and therefore minimal height impact.

Design of the roof structure

Pedestrian links are incorporated from Quarry Street and a railway station to the west, from the Convention Centre to the north, from Haymarket to the south and from the monorail along the western boundary of the site.

The footprint of the building is articulated and multi levels of activity are provided in the form of terraces, foyers and mezzanines along the Park edge to reinforce the integrated nature of the overall Darling Harbour development.

The design brief made no stipulation on the structural form or materials to be used. The consultants were therefore free to develop a range of options for consideration.

Historically, the great exhibition halls of the world — Joseph Paxton's Crystal Palace of 1850, Dutert's Galerie des Machines of 1889 among others — were conceived as steel and glass structures expressing both the technological achievement of their time as well as providing a visual relationship between the built form and their park and garden surroundings. Whereas their settings and Darling Harbour are quite different in urban context, the similarities of a park setting and large building volume offered the opportunity to reinforce this tradition of glass and innovative technology.

Several structural options of different form, span and materials were studied and compared in terms of cost, construction and aesthetics. The options investigated and conclusions drawn by the design team were:

Truss and Space Frame Systems: These systems were considered inappropriate for reasons of cost, conventionality, depth of structure and complexity of erection, particularly for a space frame.

Membrane Systems: These systems could be based on tensioned fabric or pneumatic structures but were considered inappropriate for reasons of short life span, maintenance, construction programme and co-ordination with other architectural components.

Between adjoining halls an independent structure comprising a south light truss and a suspension bridge provides support for operable walls which permit the halls to be partitioned off from each other. Service pods support the ends of the south light trusses and suspension bridges as well as housing plant and equipment.

At the eastern ends of the halls, lounges are situated at mezzanine level from which the exhibition level may be overviewed. At this level at the northern and southern ends of the building, offices are situated for administration of the Exhibition Centre.

In order to meet the very tight programme for completion of the building, 'fast track' management techniques were used to overlap the design and construction phases. The project was packaged into separate contracts for:

- foundations and concrete structure to hall floor level;
- steel supply;
- steelwork fabrication and erection;
- services, finishes and fitout.

Situated on the foreshores of Sydney Harbour, the site is underlain by Hawkesbury sandstone weathered to varying depths. In some areas unweathered sandstone occurs above site formation level. In other areas up to 20 metres of low quality uncompacted fill covers the sandstone.

Steel masts from which the suspension system are hung rise from the hall floor slab. Tie-downs for the suspension systems are anchored to tension piles which are in turn tied into the sandstone with permanent ground anchors.

At roof level a grillage of tubular steel trusses triangular in cross section span between the pickup points of the suspension system. Also at this level outriggers attached to the mast enable the sloping external suspension members to change direction to vertical for attachment to the tension piles.

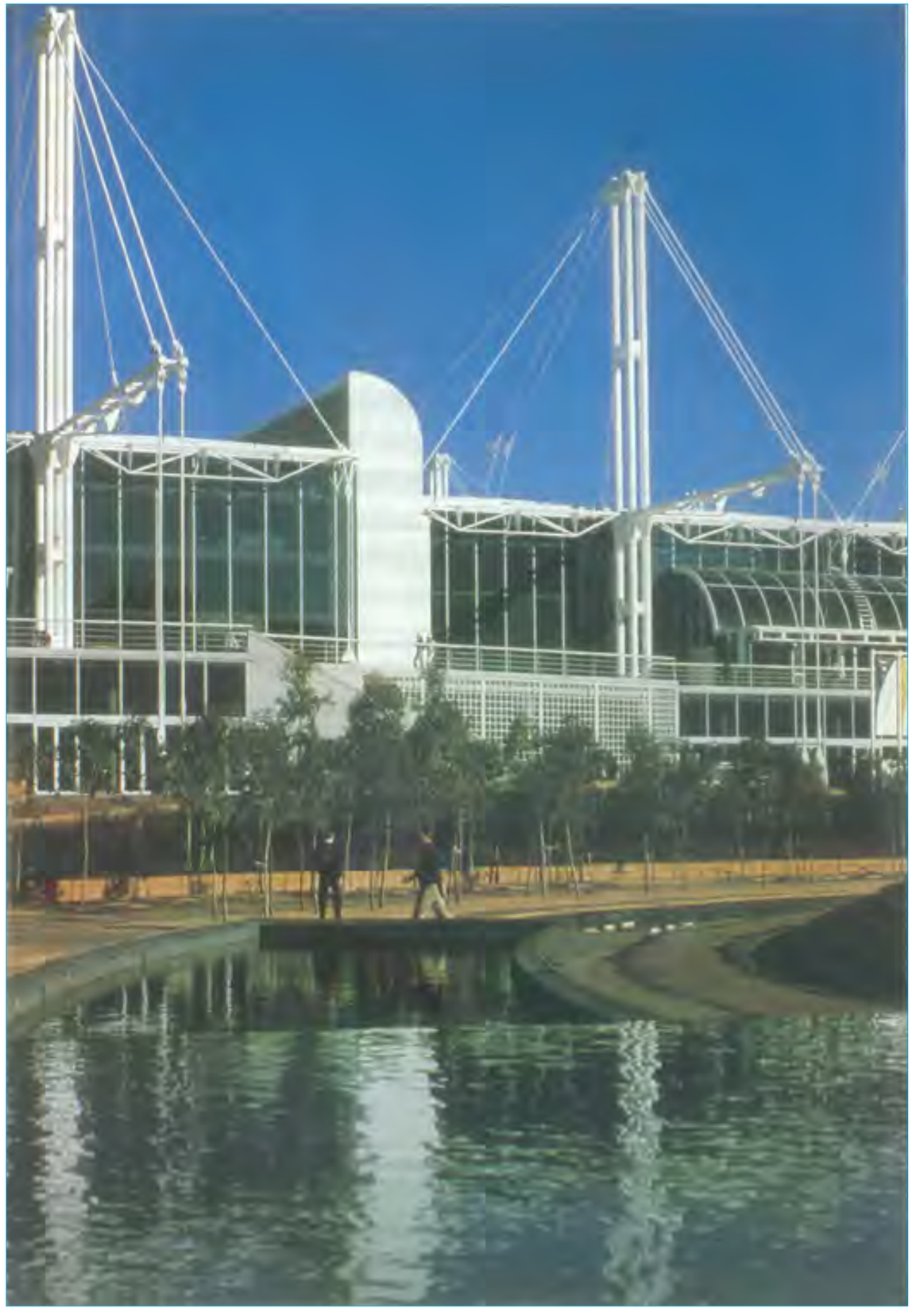
Members in the suspension systems are fabricated from circular rod section with pinned connections to provide angular tolerance during erection and to permit rotation as loads are applied. Turnbuckles are incorporated in some of the suspension rod assemblies to permit adjustment during erection.

Design

Loads

The roof grillage, masts and suspension system have been subject to various load combinations to determine the most critical forces in the structural elements. These load combinations are based on the following components:

- Self weight of roof grillage, purlins & sheeting: 0.61 kPa.
- Services: 0.25 kPa.
- Live load: 0.25 kPa.
- Hail load: 0.60 kPa.
- Windload — in accordance with AS 1170 Part 2 for 50 year wind in Category 3 terrain.



Darling Harbour Exhibition Centre

Analysis
Analysis was carried out in three stages:
- two dimensional linear analysis with simplified modelling of masts and roof grillage components;
- three dimensional linear analysis with explicit modelling of masts and roof grillage components;
- three dimensional non-linear analysis.

Two dimensional linear analysis. Several structural systems were analysed to this extent in the preliminary design phase to enable architectural appraisal and costing to be carried out. Three dimensional effects were calculated manually. Since it was necessary to place an order for the bulk of the steel before design development was complete, the ordering schedule was prepared on the basis of this analysis.

Three dimensional linear analysis. Due to the small amount of redundancy in the structure, the three dimensional analysis gave very little refinement to the information obtained from the two dimensional analysis. However, it did enable the deformation pattern of the structure to be established for the different load conditions more readily. It also enabled differential thermal effects in the roof grillage and suspension rods to be examined.

Three dimensional non-linear analysis. The linear analyses neglect two aspects of the behaviour of this structure which have an impact on the design of some of the structural elements. These are:
- The axial stiffness of the non-vertical rods in the suspension system varies due to the different applied tensile loads. This is due to the rods sagging under their self-weight, this sag reducing in a non-linear manner under increasing axial load. In fact, even the vertical rods which behave linearly under varying tensile loads have zero axial stiffness when subject to axial compression.
- The axial tensile loads in the suspension rods are balanced by axial compression loads in the roof grillage, outriggers and masts. In addition, wind loads induce horizontal forces in the plane of the roof.

On the roof grillage in particular the effect that these axial loads have is dependent upon the vertical deflection of the roof grillage. This effect, commonly known as P effect, is also non-linear. The non-linear analysis is an incremental analysis which adjusts the geometry of the structure to include deformations from the previous load increment. This analysis was carried out using an in-house non-linear finite-element programme on a DEC 10 computer.

Connections in the suspension system were analysed by finite element methods to ensure that the load transfer from cheek plates to pins could take place without unacceptable stress concentrations.

An analysis was carried out to attempt to establish the natural frequency of the roof and to identify the likely response to oscillating loads which may be applied to the roof. This was difficult to determine due to the non-linear behaviour of the structure referred to previously. However, a natural frequency 1·2 Hertz was determined which is comfortably clear of the vortex shedding and gusting frequencies of the 50 year wind.

Fabrication Details

The tension structure and roof grillage have been fabricated from tube rod and plate of grades 250 and 350 steel. These elements form a major part of the architectural treatment of the building, both internally and externally. The forms of the various components were chosen to reflect as accurately as possible their structural functions.

The masts are of vierendeel truss form with circular tubes connected by double plate welds. The roof grillage comprises triangulated trusses triangular also in cross section, and the outriggers are tapered vertically from centre to ends with horizontal guys contributing to their lateral stability under compression loading.

A great deal of attention has been given to the detailing of connections and this has been followed through to the final fabrication of components to ensure that the standard of their finished appearance is commensurate with the visual importance of the structure. Complex profiling of the ends of tubular members was carried out to provide a clean appearance at truss nodes. Welds which are evident in the final structure have been dressed to enhance their appearance and the pin connections in the suspension system have been proportioned to visual as well as structural requirements.

The appearance of the steelwork has been further enhanced by high grade paint systems providing coatings of some 220 microns thickness to the steel.

Erection

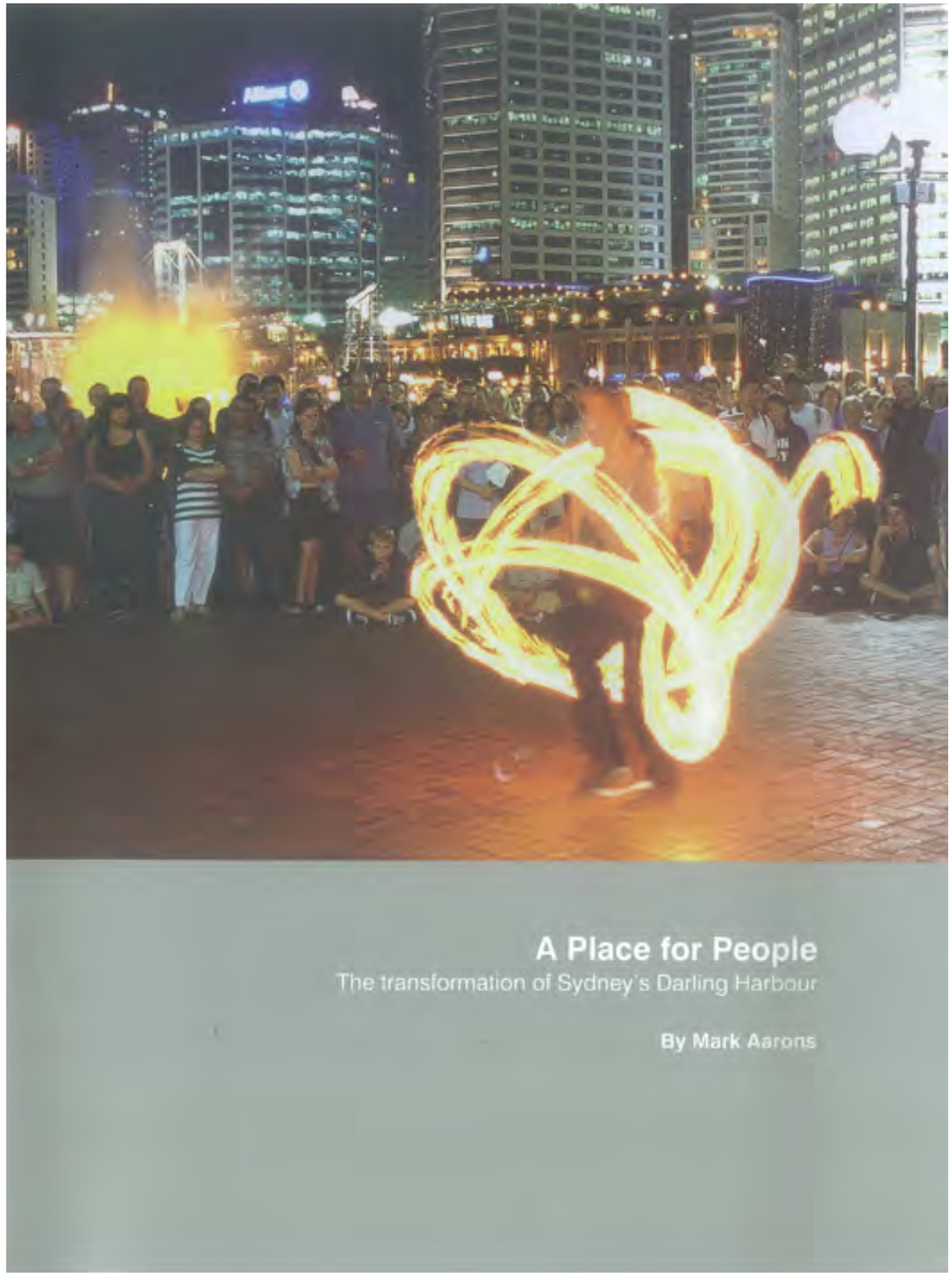
The design documentation included a suggested erection procedure for the masts, tension structure and roof grillage which involved the use of two cranes and some temporary guys for stability. The contractor, Alico Steel Corporation Pty Ltd, adopted this sequence with some minor modifications. Instead of temporary guys for stability they chose to erect temporary supports under the roof grillage. The erection was carried out using only two mobile cranes.

Philip Cox & Partners

Hall Exhibition level plan

1. Hall Number 1 and Banquet Hall
2. Hall Number 2
3. Hall Number 3
4. Hall Number 4
5. Hall Number 5
6. Drop-off and entry
7. Main foyer
8. Circulation foyers
9. Terrace
10. Toilet facilities
11. Snack bar
12. Storage
13. Cleaners rooms
14. Workshop
15. Loading dock
16. Truck bay
17. Fire stair
18. Lift
19. Service area
20. Servery kitchen

Project Team for Exhibition Centre
Managing Contractor
Leighton Contractors Pty Ltd
Architects
Philip Cox and Partners Pty Ltd
Structural Engineers
Ove Arup and Partners
Mechanical Engineers
W E Bassett and Partners Pty Ltd
Electrical Engineers
Addicoat Hogarth Wilson Pty Ltd
Hydraulic Engineers
D Cressey and Associates Pty Ltd
Cost Planners and Programmers
Leighton Contractors Pty Ltd
Photographer
David Moore


A Place for People
The transformation of Sydney's Darling Harbour
By Mark Aarons

Cover: [illegible]

And he sees the vision splendid
of the sunlit plain extended,
And at night the wondrous glory
of the everlasting stars.

Clancy of the Overflow
Banjo Paterson

A Place for People

The transformation of Sydney's Darling Harbour

Mark Aarons

Contents

This book was published to commemorate Darling Harbour's 21st Anniversary in 2009.

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Level 6, 66 Harrington Street
Sydney NSW 2000 Australia
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Harbour Foreshore Authority

As Sydney's place of celebration, fireworks are synchronised with the Darling Harbour experience. Photograph Matthew Vasilescu

Message from the Premier of New South Wales

The Hon Nathan Rees MP, Premier of New South Wales

The renewal of Darling Harbour in the 1980s set an example to governments everywhere. It showed how major infrastructure projects, combined with the preservation of heritage areas, could deliver lasting benefits to communities – creating better lifestyles, and creating jobs.

By opening up new urban spaces for leisure, commerce, tourism and recreation, we can also deliver a massive stimulus to the economy and create thousands of jobs in the process.

Today the revitalised Darling Harbour contributes more than $4 billion annually to the State's economy. More than 190 tourism, retail and leisure businesses operate in the precinct. These businesses employ more than 15,000 people and many nearby businesses are thriving because of them. The area is host to some 40 free public events and 28 million visitors each year.

Neville Wran's Government achieved much with its visionary plans for Darling Harbour. There were plenty of critics of the Darling Harbour plan in its day. Architects argued its merits; town planners and developers had different priorities. But the result was one of the great urban renewal projects since European settlement on these shores.

The key to Darling Harbour's success was a far-sighted philosophy of governance based on sound principles of public benefit. It recognised that major areas of Sydney foreshore are of regional and State, if not national, significance. They therefore require State-driven renewal in a way that is responsive to the State's economic priorities, with the State retaining long-term ownership of lands. Private enterprise and the wider community share the long-term benefits.

That remains the NSW Government's approach. Barangaroo will be the next stage in this historic and exciting story of foreshore renewal. Leadership principles pioneered in Darling Harbour will continue to underpin Sydney's foreshore management today and into the future. When completed, Barangaroo will deliver an unprecedented 14 kilometres of unbroken foreshore access from Anzac Bridge to Woolloomooloo. An estimated 20,000 people will live and work there.

Accordingly I am delighted to commend this short history, and commit the NSW Government to continuing those principles and ideals, ensuring that Sydney's treasured foreshore remains relevant to our society, accessible to the people, and indispensable to the State's growth and prosperity.

Nathan Rees, MP
Premier

April 2009

Foreword

... from its opening day, Darling Harbour immediately won the public's heart, and joined the landscape of Sydney's most-loved and 'must see' places.

On the occasion of Darling Harbour's 21st anniversary, it is my pleasure to provide this short history of its transformation, from a post-industrial wasteland into Sydney's playground, a place for people.

The following narrative – based largely on an oral history project conducted by Sydney Harbour Foreshore Authority – provides us with the story of that transformation from the perspective of the key people who drove it from conception to reality.

Beyond the interest, intrigue and drama it provides in its own right, this story is a timely reminder of both the long-term value of urban renewal, and of the sustained challenges to implementing large-scale change within a city.

We are also reminded of the challenges that were mounted to oppose the renewal of Darling Harbour. Derided as a 'white elephant', criticised as 'undemocratic', scorned as 'Snarling Harbour' – Australia's most popular entertainment precinct was treated with something akin to contempt right up until the day it opened.

Those of us old enough to remember will note parallels to the story of Sydney's other great 'white elephant', the Opera House. Those of us who are younger can find similarities in the predictions of doom that followed the construction of Olympic Park, or which seem to arise any time Sydney embarks on a major transformation of its urban landscape.

Yet, from its opening day, Darling Harbour immediately won the public's heart, and joined the landscape of Sydney's most-loved and 'must see' places.

So natural is Darling Harbour's place in modern Sydney that few people can conceive how this part of Sydney used to be. Nor can they imagine the alternatives that would likely have replaced it had the Wran Government not implemented its master-planned renewal.

We now know, from observing similar waterfront areas around the world, that without a clear vision and government leadership, incremental privatisation and stratification are the most-likely results. When this happens it destroys the public domain possibilities of the land, as well as the potential for future governments to transform it again, should the city's needs change.

Fortunately for Sydney, the principles of state government ownership and control ensure that Darling Harbour remains publicly in public ownership to this day, thanks to the foresight of the Wran Government.

The Foreshore Authority is its contemporary custodian, providing services for the 28 million visitors it attracts each year, and preserving and constantly upgrading its facilities to serve Sydney and New South Wales into the future. In that capacity we are pleased and proud to be able to document the birth of 'modern Darling Harbour' for posterity.

Finally, my personal thanks to The Hon Neville Wran, Mr Garry Gleeson and Mr Bob Pentecost for their oral histories, which are the foundation of this book. Thanks also to the author Mark Aarons and the Sydney Harbour Foreshore Authority team.

Mr Robert Domm

Mr Robert Domm, Chief Executive Officer, Sydney Harbour Foreshore Authority

The vision splendid: Neville Wran and Darling Harbour

Since the last 25 years, we've been developing this city to be something Pericles would've been proud of. The Opera House started the wonderful vision of what Sydney could be all about, or I suppose it started even further back in the 1930s with the Harbour Bridge. It was the first large-scale structure that showed ability, flair, imagination, scale and pointed to the future. Now we have the further opportunity of coming around into Darling Harbour, of creating civic areas so our civic buildings, our museums are areas of civic quality such as theatres and convention centres and halls.

Philip Cox, architect, 1999

The summer of 1969–70 marked my transition from adolescence to early adulthood. Having just finished the Higher School Certificate, I was keenly anticipating the next phase of my life with university studies to commence as soon as the holidays were over. It was a summer of great contrasts: hitch-hiking with a friend to Byron Bay on a whim and camping on the beach on a warm and balmy night; sleeping late and partying even later; enjoying the exhilaration of freedom from months of study and school discipline.

It was also the summer that I had my first glimpse into what I imagined one of my favourite poets, William Blake, had meant when he wrote about the 'dark Satanic Mills' of England's industrial revolution.

For another part of that summer I laboured in one of the goods sheds at Darling Harbour on Sydney's southwestern fringes. As I loaded seemingly endless rows of 16-gallon steel kegs of beer and huge quantities of cigarettes for towns whose names I barely knew – Cootamundra, Harden, Batlow, Adelong, Tumbarumba – the area's bleakness was oppressive.

A century of soot from the steam trains that had only recently stopped running into the goods depots and shunting yards covered every surface and seemed to permanently cover me, permeating my every pore. Only wan rays of sunlight penetrated the gloom of the dilapidated metal sheds, making it especially hard to spot the cunning foremen who lingered around every corner to catch anyone loafing on the job.

It was a ramshackle, ugly part of the city, with decaying wharves, rotting tin sheds, inevitably infested with the cockroaches and rats of old working-class inner-city Sydney. It had been neglected for decades and bore the marks of what seemed a bygone era when coal lumpers, wool-bale lifters and general duties wharfies endured backbreaking work under often inhumane conditions.

Darling Harbour shrouded in smog, 1950. Steam trains and steam ships created major pollution problems. Photograph State Library of New South Wales.

And yet there was something of a stark beauty too, and a harsh reminder of our social and labour history that saluted the rugged determination and inherent rebelliousness of the average Aussie worker.

Time and progress was, however, inevitably catching up with Darling Harbour. Cargo containerisation and increased road haulage were already taking off in a big way and within a few years would sweep away more than 100 years of history. Over the following decade, however, Darling Harbour remained as it had been in the summer of 1970 – dirtier and even more neglected, if that were possible.

This was the reality that confronted a new breed of New South Wales Premier in the early 1980s. Labor's Neville Wran had scraped into office in 1976, ending 11 years of Liberal-Country Party government. In 1978 he had the first of successive 'Wranslides', in an early election that stamped his unchallenged dominance on state politics that would prevail into the mid-1980s. From then on his nickname became 'Nifty' Neville in recognition of his pre-eminent political and communications skills.

1976
Neville Wran first wins power in New South Wales.

By 1982, in the wake of his second 'Wranslide', the Premier was eager to make a real difference to both the quality of Sydneysiders' lives and the neglected end of their cityscape: the southwestern fringes of the Central Business District, with its filthy, decaying centrepiece at Darling Harbour.

From this grew Neville Wran's 'vision splendid' for Darling Harbour, which drove him to take on what many said was an impossible dream. To make it a reality his government would endure widespread community condemnation and, frequently, hostile opposition.

As he surveyed the area, with its 'tumbledown, galvanised iron buildings', Wran let his 'imagination work' and gradually formed a practical vision of its transformation into a place that took full advantage of 'the beautiful harbour all around it'. Almost 30 years later, Wran simply says: 'I probably didn't see it as any grand plan, but we were constantly doing things we thought would give some slightly, only very slightly, better quality of life for people.'

Foremost on his agenda 'was to provide a place where people could enjoy themselves, where families could come, children were safe, parents could relax and all for the price of a glass of lemonade or an ice cream because you wouldn't get charged to get in'.

Wran could clearly see Darling Harbour's natural advantages, 'wonderfully located in the centre of the Central Business District. You can walk through Sydney and have lunch at the Botanical Gardens and have a cup of tea or whatever else you want to have in Darling Harbour, and all within a reasonable walk for a reasonably fit person'; and even better, you could do this within the heart of 'one of the most beautiful cities in the world'.

Sydney's natural beauty centres on its harbour, believed by many to be the most magnificent in the world. 'Whatever we've done to destroy or harm it, the harbour is better than all of us. Why wouldn't you be out enjoying it? You'd have to be mad not to,' Wran declares.

According to Wran, the government's decision to redevelop Darling Harbour followed what 'might be said to be a bit of a double cross'. In 1980 fierce bidding commenced between New South Wales and Victoria for the 1988 World Expo, which happened to coincide with the massive national celebrations planned for the Bicentenary of European colonial settlement on 26 January 1788.

By 1982 it looked as though Wran's bid for the Expo had won the day in Canberra, where the decision about which city to nominate would be made. Then Wran found the rug had been pulled out from under his feet when Queensland emerged as a contender:

The federal government, of course, had the major control of the preparations and application, and the federal government was the Fraser National–Liberal Party government. The government in New South Wales was Labor, and it's fair to say that at times we weren't altogether considerate of each other. And the government in Queensland was National Party, led by Joh Bjelke-Petersen. And the relationship between Fraser and Bjelke-Petersen was much stronger than the relationship between me and Fraser.

At that time, Wran 'was reluctant to commit a huge amount of money to Expo. I thought it was over the top, particularly since the buildings to be erected for an Expo were normally taken away after Expo was finished.' The Premier was, to say the least, less than enthusiastic about going down that path:

You spend a couple of billion dollars and finish up, literally, with a hole in the ground. I didn't think much of that and I suggested that we go for a modified Expo, something that would be smaller and as a result would be less costly to the taxpayer. But I was assured that the Bureau International des Expositions in Paris would not accept any modification of their concept for the Expo. You either ate the whole beast or you got nothing at all.

Ultimately, Wran decided that Expo was too expensive for New South Wales:

I barely got that thought out of my mind and it was announced that Queensland had been awarded the Expo and, yes, they would modify it, which I thought was a bit hot, but they got it. Ain't much I could do about it. So then I thought: 'Well what can I do?' The Bicentenary was coming up in 1988 and I decided we'd have our own Expo in Sydney, but an Expo designed in such a way that we'd have buildings which would be useful and facilities which would be beneficial for the public.

So Wran 'sent out search parties to find a suitable site because we didn't have Darling Harbour in mind. We didn't have anywhere in mind all along.' The man he chose to lead the team was Gerry Gleeson, Director General of the Premier's Department. As Wran remembers, Gleeson eventually recommended Darling Harbour:

which was a run-down, worn out goods yard with a collection of old tin sheds, which incidentally became heritage buildings when I decided to knock them down. But they weren't heritage buildings, they were little, worn out galvanised sheds. But at any rate, we decided upon Darling Harbour.

1982

Brisbane is awarded the 1988 World Expo over New South Wales and Victoria.

The Hon Neville Wran AO, QC
Premier of NSW 1976-86.

... which was a run-down, worn out goods yard with a collection of old tin sheds, which incidentally became heritage buildings when I decided to knock them down. But they weren't heritage buildings, they were little, worn out galvanized sheds. But at any rate, we decided upon Darling Harbour.

When container ships outgrew Darling Harbour, the waterfront facilities and rail yards were abandoned and became derelict.

Tom is a bit of an intelligent dreamer. He could convert fantasy into reality. He had ideas of what should be done for Darling Harbour...

A few weeks out from the March 1984 election – which was to be Wran's toughest electoral challenge since his knife-edge win in 1976 – the Premier convened a meeting in his office:

I asked a number of leading developers to come and sit around a table and told them we wanted to do something spectacular for the 1988 Bicentenary. They listened, but the developers turned their backs on Darling Harbour. Only one person put his hand up to participate and that was Tom Hayson. Old Tom put his hand up and as a result we got a big hand. He was very involved with Darling Harbour and will forever more, I imagine, be remembered for his involvement because without Tom I doubt we could've gone ahead. He gave us sufficient confidence to go ahead, whereas the rest of them did their sums quickly and thought: 'Oh we can't earn a bob out of it.' I think they were probably right about that, but there wasn't much Sydney spirit amongst the developers.

As a result of the developers turning Wran down flat, "we had a difficult time in getting it off the ground and building, from the grass roots, the complicated series of buildings that became Darling Harbour".

For Tom Hayson, however, self interest and altruism happily coincided with Wran's vision. Hayson had begun purchasing the huge disused wool stores adjacent to Darling Harbour in 1979. He had been exploring options to redevelop them, but had been frustrated by the Sydney City Council, which dragged its feet on his rezoning applications. As early as 1979, however, his own nascent vision of a wider plan to revitalise the entire area of Darling Harbour had begun to emerge. As things turned out, Hayson would play a central role in what would soon become a mega-project.

The former Premier remembers this visionary developer with great affection: "Tom is a bit of an intelligent dreamer. He could convert fantasy into reality. He had ideas of what should be done for Darling Harbour and one of the things he did was to introduce us to an American civil architect, Mort Hoppenfeld".

Hoppenfeld had played a big role in the redevelopment of the US city of Baltimore, which had set the standard for inner-city refurbishments around the globe, and his design experience would prove critical in the Darling Harbour story.

Premier Wran's vision for Darling Harbour was part of his wider philosophy of making Sydney accessible to ordinary people. In this he adopted Leo Schofield's slogan that Darling Harbour would be "A place for people":

We wanted it to be a people's place, where families could go and for a few dollars have a pleasant afternoon and go away satisfied. I was always very keen on getting people doing things. Darling Harbour was the start of it. We also abolished entrance fees for museums and galleries, put in place fares on the train so that a bloke could buy a ticket for himself, his wife and his two kids. It was quite pleasant going to the galleries, seeing families wandering around and looking at things, poking around. Under ordinary circumstances they would never go near a gallery to look at a painting. But then it cost them nothing and they could spend an afternoon, and they found that they liked the pictures.

To deliver this philosophy the government put in place a massive capital works program for the Bicentenary. While Darling Harbour was the centrepiece that captured the community's attention, it also included other major components: turning the abandoned Pyrmont Power House into a modern museum, extending the traditional Australian Museum, the Art Gallery and the Mitchell Library, building the connection between the Opera House and Circular Quay, moving the Maritime Safety Board from the western side of Circular Quay to make way for the Museum of Contemporary Art, and embarking on the biggest road construction program in the state's history.

It was an ambitious program that would transform Sydney into the modern city it has now become, but Darling Harbour would be the jewel. Not everyone, however, was as enthusiastic about Premier Wran's vision as Tom Hayson.

The inaugural Teddy Bears Picnic at Darling Harbour in October 1985, held to raise funds for the Sydney Children's Hospital.

Planning 'a place for people'

We can tell something about a kind of clawing, grasping 'reach for the sky' mentality which sees the necessity to knock something down in order to build something bigger on top. Perhaps that has existed from time immemorial. Perhaps Nineveh was built like that and Memphis and Athens and so on. Perhaps Pericles was accused of being the Laurie Brereton of his time. I don't know. But Sydney has got a very exciting quality about it, even though it's one person climbing on top of another, in a sense, to get to the top.

Professor John Haskell, architect, 1988

On 1 May 1984 Premier Neville Wran announced an ambitious plan to rejuvenate Sydney's Darling Harbour as his government's gift to the people of New South Wales for the 1988 Bicentenary celebrations. The decision reflected the collective will of Wran's Cabinet, which drove the process, at each stage considering the planning and financial issues as designs were adopted, budgets approved and demolition and construction got underway.

Despite close political supervision, the project would be dogged by controversy and often strident opposition, as sections of the Sydney community argued that there were better uses for the site, including public housing or a massive green space. From Wran's point of view, however, there was not a minute to spare if the project was to be largely financed on time. There were exactly three years, eight months and two weeks to turn a nineteenth-century industrial wasteland into a people's precinct that would also fuel the city's economy, fill a commercial void to encourage private sector investment in Sydney and provide for much needed expansion on its south-western fringe.

The scale and nature of the plan were breathtaking and would normally have involved at least a decade of careful and intricate planning, design and construction. It called not only for the demolition of the run-down site, but for the construction of the biggest urban redevelopment in Australian history, encompassing major exhibition and convention centres, parks and gardens, public access to the harbour, a Chinese garden, a national maritime museum, an aquarium, public transport into and out of Darling Harbour from the Central Business District, as well as harbourside retail, hotel and business facilities.

The man chosen by Wran to oversee this gruelling series of major projects was his Public Works minister, Laurie Brereton, and the budget would eventually reach $2 billion (in today's currency, $3.6 billion). The design and construction work was undertaken by

Darling Harbour concept plans by Project Design Directorate, MSJ Group, from December 1984 to June 1988. The Director, Barry Young's vision was to design a pedestrian precinct that put people first. By reversing the norms of development. With parks and open spaces central to the design, followed by buildings and then roads on the outside.

1984

In February, Laurie Brereton becomes Public Works minister, charged with overseeing the Darling Harbour project.

Aerial view of Darling Harbour in the late 1970s. Photograph Aerovision Photography.

the private sector, which turned out to be much keener on profiting from government expenditure, rather than investing in Darling Harbour's redevelopment.

Wran frequently turned to Laurie Brereton to take on the hardest challenges facing his government, like implementing major reform of the hospital system when he was Health minister the previous post he had held before becoming Public Works minister in February 1984.

A veteran of inner-Labor factional politics, Brereton had first been elected to parliament in 1970 at the tender age of 24 and had a well-deserved reputation as one of the state's most competent politicians, and one who rarely took a backward step.

infuriating those who opposed his often controversial policies.

It is a little appreciated fact of political life that the best ministers are those who are also the best administrators, who keep abreast of the (often) details of their portfolios. Wran has called Brereton 'easily the best executive in the game', a compliment coming from a Premier who was renowned for his own attention to detail.

Wran's head of department, Gerry Gleeson, played a key part in the administration of the New South Wales government from the late 1970s to the late 1980s. When Wran won the 1976 election, Gleeson was already a powerful force in the Public Service Board, which oversaw the public sector workforce.

Without Laurie Brereton, Darling Harbour just wouldn't have got up in time because we had a time limit on it.

As Gleeson recalls, at that time:

The Premier's Department was weak and ineffective, so the Treasury and the Public Service Board were really the two powerhouses. And Wran was suspicious of both of them, so he asked me to head up the Premier's Department. And his instructions to me were very clear before I got there: 'Your job is to keep an eye on all these so-and-so ministers. Make sure I know what they're doing and why they're doing it, how they're doing it'.

Soon the Premier's Department became the centre of bureaucratic power. When Gleeson knew Wran wanted something to happen he was determined to make sure it did. Gleeson developed something of a fearsome reputation, but he is a rather mild-mannered man, an effective administrator with a gleam in his eye. He had that eye constantly fixed on his political master's best interests. As he recalls:

I had a pretty special relationship with Wran. We were both driven. He wanted to be the best Premier in the world. I wanted to head the best Premier's Department in the world. Our interests coincided. He did the politics, I did the administration and we got on well. We went away overseas together, twice a year for years, just he and I together. Although we didn't mix socially we had this special relationship.

Even 25 years on, Gleeson vividly remembers the day Wran called Australia's top 14 developers around the Premier's conference table to try and get them on board for the Darling Harbour project.

The major construction and development companies were all there, including Land Lease, Westfield, Leighton Contractors, Lloyds and Wormald, among others, as well as Tom Hayson. Wran told them it was 'absolutely essential' for Sydney to have exhibition and convention centres as part of the redevelopment of Darling Harbour and encouraged them to jointly invest with the government in putting this infrastructure in place. But, as Gleeson recalls, it did not turn out as expected:

Eventually the boss of Land Lease said: 'Neville, I think it's time we told you the truth. None of us would put in a penny to build them. You can't make money out of convention centres and exhibition centres.' So then they all nodded their heads, after having sort of been a bit sympathetic to it. So after that meeting Neville said: 'Well, bugger it. We'll do it ourselves.' And that's what started it all really running hard. Laurie Brereton had by then been made minister for Public Works, so he gave Laurie the task of doing it and he was a very, very successful minister. Without Laurie Brereton, Darling Harbour just wouldn't have got up in time because we had a time limit on it. It had to be finished by December 1987. It had to be part of the Bicentenary and we had an election in March '88. So that was the scenario, it's got to be finished.

At the end of March 1984 it became apparent that Wran's electoral appeal was finally waning and Gleeson was quickly called upon to help. Although Wran was returned to office, the Liberal–National Opposition had taken seats from the government in Wran's fourth election victory.

Gleeson recalls that on the Monday morning after the election Wran made it clear:

that he wasn't elated really and he said: 'Phew, we got there.' Then he said: 'In 1988 it will be hard to win again. '76 to '88 is going to be jambly bloody hard. And we've got to start planning now for the big things we're going to do. This is our chance to do something down at Darling Harbour. This is our chance to leave something permanent for the people of Sydney'.

But what exactly did the Premier want? In fact, the government had only the most general idea of what it wanted done at Darling Harbour. It was here that Tom Hayson – the only developer who had agreed to invest in Darling Harbour – came into his own. Hayson had begun lobbying Wran about Darling Harbour's future in October 1982 and had persisted. Although he had some ideas of his own, Hayson was searching for a more concrete proposal for an adventurous, forward-looking model for the area. In late 1983 Hayson toured the world in search of the best example to follow for Darling Harbour's rejuvenation. In the course of that trip he visited Martin Millspaugh in Baltimore, the state capital of Maryland.

Millspaugh was chief executive of Baltimore's Inner Harbour Management Incorporated, which had overseen that city's renaissance in the 1960s and 1970s and reversed the decline of its Central Business District by redeveloping its decayed and abandoned old harbour, renewing the shoreline as a recreation area and adding major attractions. By the 1980s more than 20 million people

Wran had also proclaimed that the project would be driven by the Darling Harbour Authority. The new Authority would be established by legislation that gave it unfettered planning powers, stripping away layers of bureaucratic assessment and approvals.

visited each year what had been a run-down dirty industrial wasteland.

In November 1983 Hayson visited Millspaugh to establish whether Baltimore offered a model for Darling Harbour's redevelopment. Hayson was immediately struck by the marked resemblance between the two harbour precincts and became convinced that similar design and construction principles would also work for Darling Harbour.

Just as Wran was formulating his ideas for Darling Harbour in the aftermath of the March 1984 election, Hayson hosted Millspaugh for a return visit to Sydney. He made Millspaugh work very hard indeed, among other things arranging television and press interviews, a lecture sponsored by the Royal Australian Institute of Architects, a reception for key opinion leaders and even a ceremonial reception by Sydney's Lord Mayor.

This was followed up with a slide show presentation for the government's top planners and finally a meeting with Laurie Brereton. As Millspaugh has recollected, 'Brereton's office had scheduled 30 minutes, but he became fascinated with the Baltimore story and we spent 60 minutes before he would allow us to leave.' Next Hayson brought out another distinguished visitor, the legendary American developer, James Rouse, who had a long list of successful urban renewal projects under his belt, including the transformation of Boston's harbourside with the construction of Faneuil Hall and the Quincy markets, another precinct with a striking resemblance to Darling Harbour. Rouse's visit, too, had a major impact on the government's thinking, coming hard on the heels of Wran's May 1984 announcement.

Meanwhile Brereton had also been travelling the world in search of ideas. He visited London, New York, Boston and finally Baltimore where Rouse introduced him to Mort Hoppenfeld, the influential American urban planner and Dean of Architecture and Planning at the University of New Mexico, who had worked on several of Rouse's projects. During this meeting Hoppenfeld convinced Brereton that the New South Wales government's existing Master Plan – which had been developed by the government's architects – could be significantly improved by adopting a different layout of some of the key design elements.

Brereton was impressed with Hoppenfeld's concept and recommended it to Wran. Shortly after this, Hoppenfeld presented his drawing to Wran and Brereton in Sydney and the Premier personally signed it, signifying his official commitment to the amended concept. The former Premier still remembers Mort Hoppenfeld's crucial role in making Darling Harbour what it is today:

He produced the most elaborate plans and I think we probably would still be building Darling Harbour if it weren't for him. He gave us a lot of ideas and what Darling Harbour is now came from his original thoughts on the subject. It's not as good as his plans were, but nevertheless they gave us a foundation on which we could start to build.

As a consequence, the government employed Hoppenfeld to assist in finalising the Master Plan, but tragically he died of a heart attack in March 1985. While the concept may have been Hoppenfeld's, Gerry Gleeson pays special tribute to Tom Hayson's persistence:

Tom Hayson is an extraordinary fellow. He must be getting on towards 90 now, I suppose, but he was a man with a big view of things. He put his hand up to build the Harbourside shopping complex down there and he did that with style. One of Tom's attitudes towards building was that even if it cost you $10 million or $100 million, it's the last million that you spend which is the key one. He spent a lot of money at the end, just making sure the Harbourside complex was right – the tiles were right, the bird sculptures in the atrium were right. Other people would have just cut it off at that stage.

With Hoppenfeld's changes adopted by Premier Wran, it was time to get on with it. When he made his announcement in May 1984, Wran had also proclaimed that the project would be driven by the Darling Harbour Authority. The new Authority would be established by legislation that gave it unfettered planning powers, stripping away layers of bureaucratic assessment and approvals. Wran was determined to meet what many said was an impossible deadline.

Scale model of final design.

Early concept sketch of the Exhibition Centre.

Early concept illustration of Darling Walk.

The development takes shape

You're a wonder in the making
You're growing very fast
You're going to give us all a lot of pride
Good on you Darling
For all you're going to be
For moving us a monorail
For everyone to see
You're helping Sydney grow
A place for me
Good on you Darling
Darling Harbour
A great place for me

New South Wales government promotional jingle

Darling Harbour Authority Chairman, Alexander Carmichael (left), and Laurie Brereton on a site inspection.

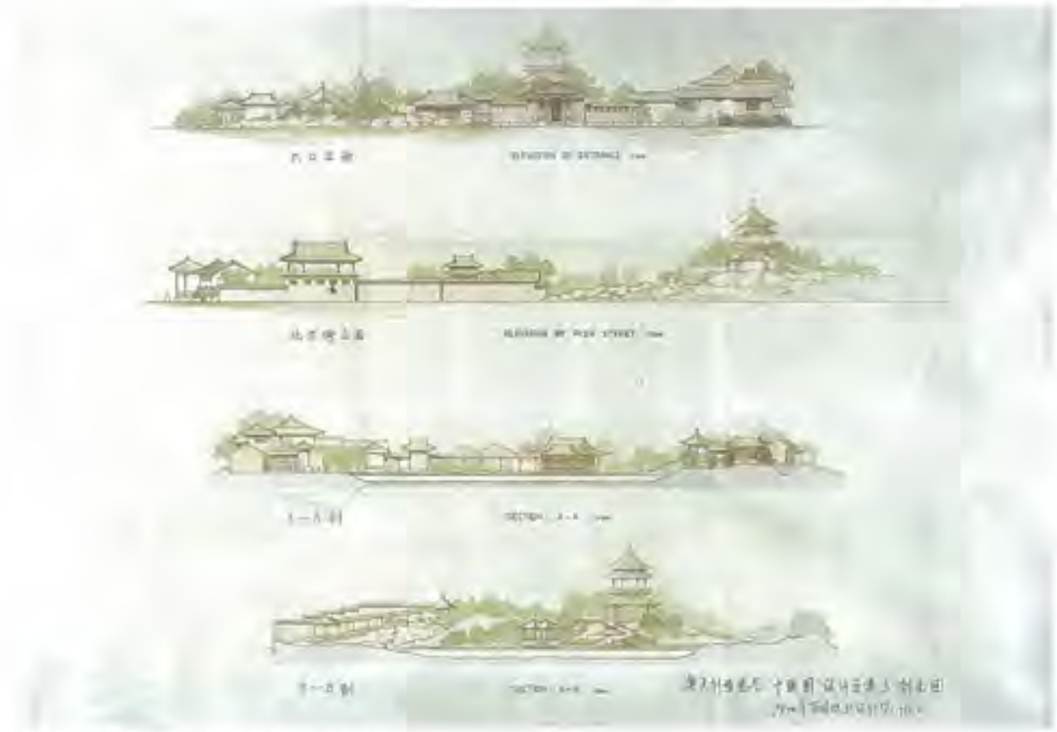
In mid-1984 Bob Pentecost was Director of the Capital Works unit in Gerry Gleeson's Premier's Department, which was firmly entrenched as the powerhouse of the New South Wales bureaucracy. Pentecost was one of many talented, hardworking young people helping to drive Neville Wran's agenda. Pentecost recalls:

I was known to some as a 'Mr Fix-it', partly because I have the ability to look at complex problems, put them into order and roll out an orderly response. Our role was to oversee the state's capital works projects. Any capital program that a minister wanted to bring forward had to come through us. We'd look at it and provide advice to Cabinet as part of the approval process and then monitor approved programs.

Pentecost's unit was powerful, reporting directly to a high-level Cabinet sub-committee consisting of the Premier, Public Works minister, Laurie Brereton, and Treasurer, Ken Booth. Soon Pentecost was helping to draft the *Darling Harbour Authority Act*, creating within five months the overarching Authority that Wran had announced on 1 May 1984.

The Darling Harbour Authority had, to say the least, an inauspicious beginning. On the very first day of demolition of the old railway sheds a bobcat drove through an asbestos sheet and the driver was killed. Then the Authority's inaugural Chair, merchant banker David Block, resigned, followed soon after by the departure of the first Chief Executive Officer, Hank Laan.

Laurie Brereton recommended Block's replacement as Chair of the Board, senior TNT executive and transport expert, Alex Carmichael, and handpicked the man who would run the Authority for much of its development phase, Bob Pentecost.



The Chinese Garden of Friendship's design was inspired by a traditional Chinese art form dating back to the fifth century.

It was to be a roller-coaster ride for Public Works minister Brereton and the Authority, especially for its Chair, Alex Carmichael, and Chief Executive Officer, Bob Pentecost.

Before departing in mid-1985, Hank Laan developed initial cost estimates as the plan took its first tentative form. This was not easy, as there were no designs for the major buildings. As Pentecost recalls, 'the estimates were really based on square metre rates: A footprint was conceived and from the footprint you could work out so many thousands of dollars per square metre and come up with a number. Pretty hairy stuff, but nonetheless that's where we were.'

Around this time, Wran went to Guangdong to sign a deal to jointly build the Chinese Garden of Friendship as a Bicentennial gift from New South Wales's Chinese sister state. Brereton nominated Pentecost to precede Wran. As a result, Pentecost played a pivotal role in securing an agreement for the Chinese to provide expertise and materials.

On his return from China, Pentecost was recruited by Brereton to replace Laan as Chief Executive Officer. Pentecost recalls that:

I got a call from Brereton to go and see him in Parliament House. He told me that Hank Laan would no longer be running the project and that he, Wran and Gleeson had formed the view that I was the person with the best chance of delivering Darling Harbour on time for the Bicentenary and how did I feel about that? It took me less than a nano-second to say: 'Yes, I'll do it.'

He was asked to nominate his replacement at the Capital Works unit, and told to 'go and brief him. He must be in the chair by one o'clock and we want you in place at the Darling Harbour Authority by two o'clock.'

Pentecost packed up his desk, 'high-tailed it down to the Authority's office 'and at three o'clock the phone call came through that Cabinet had approved my appointment'. Gerry Gleeson explains why Brereton chose Pentecost: 'Bob was an engineer. He understood builders and engineering and was a real project manager. Bob was an ambitious, capable, forthright fellow.'

By this stage the Authority's structure was up and running and the government had appointed Leighton Contractors as the managing contractor and MSJ Group as the project designers. Wran was determined that the project would be free of wider planning constraints, especially by local government.

The state government's decision on this was not taken lightly. Cabinet was convinced that delivering the project on time could only be achieved by creating a legislated Authority.

The decision to suspend all other planning powers and give the Authority the sole responsibility for the redevelopment was hugely controversial, fuelling media and community criticism.

1984

By October, the Darling Harbour Authority was ready to go to work.

suspending the *Environmental Planning and Assessment Act* and overriding the powers of all other state departments and the Sydney City Council. The high priority given to this is demonstrated by the fact that Wran personally introduced the *Darling Harbour Authority Bill* and drove it through all stages of parliamentary debate. Once it was passed and had become operational, the Premier passed the file to minister Brereton and then supported him to get the job done.

The decision to suspend all other planning powers and give the Authority the sole responsibility for the redevelopment was hugely controversial, fuelling media and community criticism. Pentecost, however, believes it was an essential precondition to success.

The Act was necessary to enable Darling Harbour to be developed in the timeframe. Decisions had to be made within a legislative framework to give them force. So all the planning decisions rested with the Authority, and ultimately the minister, and every other piece of planning legislation was excluded. But without the Darling Harbour Authority Act, we never would've achieved what we achieved because you just had to get decisions and the way to get decisions was to slim down the process.

The project was an immense undertaking, especially as planning and design were occurring simultaneously with demolition and construction. As Wran says:

Darling Harbour grew up like topsy. I wish it had been better planned, but we were fighting the clock and we had a deadline for 1988, when we had to have a substantial part of the project ready for occupation, ready for use. We made mistakes along the way. We weren't building piecemeal, but we didn't have just one sheet of paper with everything on it. It was quite a frantic atmosphere.

According to Pentecost, Wran's Public Works minister was one of the pillars supporting the whole effort:

Brereton was just fabulous. He had the ability to surround himself with 'can-do' people and then supported them to the hilt. I never had any doubts or qualms about him. No matter how hard it got, no matter how much it was hitting the fan, Brereton was always behind you. He would ring me almost every night at about five o clock: 'How's it going mate?' It was genuine. 'What can I do to help?' The chair, Alex Carmichael, gave similarly great support.

By October 1984 the Darling Harbour Authority was ready to go to work. At that stage there was still only a broad development strategy, coupled with an instruction to work with the private sector to make it happen. Pentecost recalls that he 'only had about 35 staff. It wasn't a big organisation, but it was talented and dedicated. There was this huge commitment to change Sydney and to change people's recreation opportunities in the city'.

The managing contractor, Leighton Contractors, was crucial in bringing the many disparate parts together. The design process was driven by Barry Young of MSJ Group, who assembled 30 top specialists, including engineers, landscapers and

Darling Harbour Authority Chief Executive Officer, Bob Pentecost.

In the early stages of the project, design and construction were simultaneous – with the less than four years to build, this was an imperative.

public transport experts. They would rapidly develop options for the Authority, which acted on them almost as quickly as they were completed. The final design was only ready in December 1985, but this did not even include the Aquarium, car parks and other areas on the site's periphery. At each stage Wran's Cabinet would consider and approve the redevelopment's major components, but the project was delivered by the Authority, as Pentecost recalls:

Barry Young's people would start with an initial brief. They would say: 'We've got this site and this is what we want to do. Here are the sorts of conditions that exist – prevailing winds, sun, traffic etc'. That would be looked at by our Quality Review Committee to ensure it covered the right issues, then it would go out to expressions of interest to see who might sign up for it. Expressions of interest would come in and be reviewed by Barry Young, who would do a report that would then go to the Quality Review Committee for approval and finally to the Board with a recommendation to select the developer of the site. The Board would give that a tick. That would then flow down to the Authority to develop the contract. Then the race was on to get the development plans to the Quality Review Committee so the Board could okay them and I could get them to Spinksy.

'Spinksy' was Tony Spink, Leighton Contractors' coordinator for Darling Harbour, who was 'responsible for doing the detailed design with the main party. Fundamentally it was either Philip Cox or John Andrews, with Bob Perry for the marketplace. But it was Spinksy who was driving'.

Pentecost found managing both designers and builders quite challenging. With the architects, 'it was like herding cats. I don't want to sound negative, it was difficult because they were so committed and positive. They wanted it to be so right and so good. They were really intelligent people with great vision and capacity. They were wonderful. Managing them to the timeframe was just hard.'

On the other hand, the builders were 'like big bulls in the ring. To be the head of a construction organisation, you've got to be very strong. Construction is a very difficult area and therefore the people who run and manage it are strong people. Looking after them is like looking after a whole lot of big bulls in the ring.'

The most significant design challenge involved the expressways that stalked the redevelopment site and cut it in two.

The most significant design challenge involved the expressways that stalked the redevelopment site and cut it in two. But as Barry Young has said, MSJ Group decided 'to embrace the expressways and 'take advantage of the spaces underneath and the views through by turning them into a transition space between the park area and the harbour'.

John Andrews, who designed the Convention Centre south of the expressways, decided 'to confront the expressways, not be overpowered by them'. On the northern side, Philip Cox, designer of the Exhibition Centre, concluded that two buildings with very different functions could be designed 'in an individualistic manner', but with pedestrian access beneath the expressways.

While the architects were wrestling with major design issues, a significant logistical issue emerged, as Pentecost outlines:

When we looked at the services crossing Darling Harbour, it was like a plate of spaghetti in terms of phone lines, electricity cables, sewers, gas pipes - you name it. And the stormwater overflow from southern Sydney used to just run across the top and no-one cared. If you had a 50-year flood event, the railway tracks just got a bit of water over them. But now it did matter. So what we had to do was relocate all those services into a trench and then dig these three enormous culverts to drain the southern part of Sydney. All through this, the building site was just mud and mud and mud. I never thought I'd see the end of mud.

Barclay Mowlem Construction replaced this tangled web of cables and pipes with an ordered grid and built the Exhibition Centre's five massive halls, each with individual glass foyers reflecting the adjacent parks and gardens. The design incorporated grand mast and cable spans creating a column-free 85-metre-wide expanse with 25,000 square metres for exhibitions and displays. Construction was completed in just 21 months.

The Convention Centre had to provide a forum to seat 3500 delegates, with meeting rooms, display areas, bars and a grand banquet centre that shared kitchen and other facilities with the Exhibition Centre. In delivering this, John Andrews adopted the ancient art form of the amphitheatre to provide maximum opportunities for audience interaction.

The Harbourside Festival Marketplace was designed and constructed by Tom Hayson's company to provide a place of entertainment, enjoyment and shopping. When completed, Harbourside marketplace contained eight waterfront restaurants and cafes, 30 international specialty food outlets, a 600-seat tavern and over 200 retail outlets. It provided seven-days-a-week retail shopping in a 300-metre- long marketplace, with two wings joined at the building's centre, a 25-metre-high vaulted glass atrium with crystal galleria, mirrored waterfalls, palms and tropical plants and the stunning nine-metre-high *Oceania* sculpture.

The Chinese Garden marks the transition from Darling Harbour to adjacent Chinatown, providing a tranquil zone amid the chaos and bustle of Day and Goulburn Streets. Construction was undertaken by Stuart Brothers, while Civic Trees supplied the flora. Chinese and Australian craftsmen worked together to build the feature walls and structures, inspired by an art form dating back to the fifth century. Amazingly, all the instructions were in Chinese and merely conveyed the *intent* of the final garden. It was a particularly demanding project, with 13 Chinese specialists working with a contingent of 70 tradesmen using entirely foreign materials and construction methods to create structures previously unknown in Australia. The planting of appropriate flora included a seven-metre-high native maple, adding a touch of Australianness. The Garden's ponds were appropriately stocked with a school of carp and the result was a miniature world of three-dimensional landscapes viewed through the doors and windows of ancient-style pavilions.

The parks and gardens that run from the southern end of Darling Harbour and link to the harbour under the expressways were designed by MSJ Group and built by Stuart Brothers with the flora supplied by Civic Trees. The five hectares reserved for them was controversial, especially for those who wanted the entire site to be green open space. The brief was to create a place to rest and enjoy the views, as well as giving cohesion to the nearby buildings and promenades.

Construction was especially difficult as the area was a major thoroughfare for thousands of building workers and it lay on landfill, making foundations difficult to secure. Inside one year, huge underground maintenance

The concrete flyovers that dissect Darling Harbour created significant design constraints and opportunities for Darling Harbour Project Design Director, Barry Young.

Modelled on the festival markets of Baltimore, the Harbourside marketplace was decorated with the distinctly Australian artworks of more than 30 of Australia's top artists, muralists, designers and craftspeople.

1985

By November, construction had commenced on the Convention Centre, and the Waterfront Promenade.

areas were built, together with central services facilities and the 'tower of power' housing lighting and sound controls.

Civic Trees planted hundreds of semi-mature eucalypts, native flora and mature palms and oversaw the relocation from Homebush of 'Fred', a 70-year-old Port Jackson fig, which became the centrepiece of Tumbalong Park (named after the Cadigal word for the area, which had been an ancient gathering place for local Aborigines). The gardens also encompass an amphitheatre, children's playgrounds and dramatic water features such as the Dancing Waters Spiral.

The Aquarium was designed by Phillip Cox as a 15-metre-high, 140-metre-long breaking wave with three elements: the main building and two massive tanks, partially submerged into the harbour, housing the Shark and Harbour Oceanaria which create the illusion of walking on the ocean floor.

Phillip Cox also designed the Maritime Museum, the first national museum built outside the national capital, Canberra. That it got off the ground at all came down to Prime Minister Bob Hawke's commitment and to the decision of the American government to provide significant funds as a gift for the Bicentenary, supplemented by private fundraising undertaken in the United States by Washington's Ambassador, Laurence W Lane. Built by Allco Steel, the Maritime Museum showcases Australia's maritime heritage, including historic charts and instruments, sketches of ships and craft and the ships themselves. It is reminiscent of tall masts and billowing sails and its exhibition space runs 100 metres end-to-end and is 38 metres high to accommodate tall masts. Historic vessels are moored at two finger wharves.

Designing and constructing such a large-scale project in just over three-and-a-half years was extraordinarily ambitious. Miraculously, much of it was ready for its first public showing in mid-January 1988. The Exhibition Centre, Chinese Garden, Tumbalong Park, children's playground, outdoor performance area and waterfront promenade were all completed by then. This is a major tribute to Bob Pentecost's team. He in turn pays tribute to Leighton Contractors' Tony Spink.

Every Wednesday I'd walk the entire site with Spinksy and Peter Wade, my right-hand men on site. I was visible and everyone could see me. I was always out there and made decisions. If I made a decision, what I liked about Spink was that he was not a crusader – he didn't challenge anything. He was there to do what the Authority wanted. If I wanted to do something, he'd say: 'I'll get to it.' By the time I got back to my office, I'd have a memo from him noting what he'd been asked to do and asking me to sign it off. I'd sign it and get it back to him. He was really good at keeping the paperwork up and indicating any cost implications. I'd come on site anytime to do whatever needed to be done and it was just push, push, push. In the last two months we actually walked the site every day.

This frenetic pace went on even after mid-January 1988. By July, the Aquarium and Convention Centre were both finished, as was the Monorail link to the Central Business District, which became the flashpoint for criticism and opposition to Premier Wran's vision for Darling Harbour.

By June 1986 work was underway on the Exhibition and Convention Centres, and the Chinese Garden of Friendship site was excavated. Photograph Paul Sinclock.

The Australian National Maritime Museum (pictured during construction) was designed to complement the Darling Harbour environment in an aesthetic and practical way.

Controversy

Pardon me boys
Is that the Darling Harbour Monorail?
The Jelly Express
Well I'm just not impressed

Can we afford to board
The Darling Harbour Monorail?
I've got my fare
But will it go anywhere?

Because we'll go 'round in circles
Like it was Disneyland
A Laurie Brereton nightmare
That just wasn't planned

He said it won't take long
But we know that he's wrong
We'll be stuck more waiting
While our teeth are grating

When the Pyrmont Bridge is open
It will not move
That's when we'll know
That Mr Brereton's option

We're going to cry
Until we're sure that it will never run
So Darling Harbour Monorail
Won't you choo choo on home?

Acapella song by The Skirts, sung to the tune of Glenn Miller's 'Chattanooga choo choo'

Neville Wran was determined that Darling Harbour would be a people friendly pedestrian precinct, with vehicles restricted to parking around the periphery of the Convention and Exhibition Centres, the Harbourside marketplace and the Maritime Museum. The design effectively made Darling Harbour an island surrounded on three sides by major roads and by the harbour on the fourth. While many visitors would enjoy the walk from the city across the Pyrmont Bridge, the aged, disabled and families with young children could not be expected to walk several kilometres from the city and back again to the rail, bus and ferry systems.

A public transport link was required to bring millions of people each year into and out of Darling Harbour. The government, however, decided not to fund construction of a transport link for Darling Harbour, but to involve the private sector instead. One of the major considerations in choosing a transport option revolved around Tom Hayson's commitment to fund and build the Harbourside shopping complex. It would have been a betrayal of the only developer who supported Wran's vision if his markets were to be cut off from the city, so the government undertook to deal with the issue.

It quickly emerged that some form of rail link would be the best option and this helped decide the future of the historic Pyrmont Bridge, on which the government spent considerable amounts to have it lovingly restored, having initially proposed its demolition. The bridge was the only route for a rail link to service Harbourside and the wider Darling Harbour precinct, but it was unsuitable as a platform to carry light rail.

Although controversial at the time of construction, the Monorail remains an important transport link to the city and a tourist attraction

In order to resolve the transport issue, Cabinet established a sub-committee of Public Works minister, Laurie Brereton, Transport minister, Barrie Unsworth and Environment and Planning minister, Bob Carr. The option ultimately recommended to Cabinet was Sir Peter Abeles's proposal for a Swiss-technology Monorail, which the government realised would be intrusive in the older parts of the city, although it rejected the plan to take the route along Hyde Park. The Sydney Monorail was built by Alloc Steel and owned by Abeles's company, TNT. It was a simple solution, but it fuelled controversy throughout the construction period.

The Monorail became the key rallying point for opposition to the project, crystallising the arguments against the redevelopment. It did not matter whether the critics were advocates of preserving the industrial heritage of Darling Harbour, or wanted public housing, a huge public green space, or opposed the haste with which it was being redeveloped and the exclusion of the City Council; the Monorail united all opinions in one huge protest movement that dubbed it the 'Monsterail' and referred to Darling Harbour as 'Snarling Harbour'.

As one prominent architect, Professor John Haskell, said at the time:

There's no doubt that Darling Harbour is going to generate an enormous amount of traffic. It's also pretty clear that the Monorail isn't going to solve much of that traffic problem. It's sort of a gimmick and doubtless it'll be very popular. It'll be a popular thing like Disneyland, going around, looking at the sites, but it's not going to shift thousands of people per hour as has been proposed.

The project involved the erection of 3800 metres of steel tracks and support pylons. The design had to adapt to Sydney's hilly topography so the Monorail could climb and twist on its city route, accommodate Pyrmont Bridge's swing span and snake around many city buildings.

The Monorail's brief was simple: carry up to 5000 people an hour, seven days a week on six trains, linking the city and its public transport system to Darling Harbour. The critics said it could not be done.

Laurie Brereton defended the Monorail decision with combative resolve, despite public and political criticism.

Even strong supporters of Darling Harbour had reservations. Philip Cox, designer of the Exhibition Centre, Aquarium and Maritime Museum had mixed feelings:

The Monorail really does facilitate the transportation of those who want to get there quickly from the major retail nodes of Pitt Street or Park Street. Despite the obvious problems of environmental conflict with the nobility of the earlier historic buildings, the Monorail will give people a new perspective about what the city is all about. It's just unfortunate, the engineering of it. However, I'm sure it's going to be a very popular thing for people to ride on despite all that. It's a bit like being in a helicopter, looking down at the city.

So in one sense I'm not supportive and in another I am. It's a way of getting people around without the extraordinary expense of underground railways, or buses, or surface transport. Where it does work is against the new buildings. It works against the Exhibition Hall, beautifully. It looks right. It feels part and integral with those buildings as it flashes around the Festival Market [Harbourside marketplace] building. But where it comes into conflict with those older buildings, it looks absolutely wrong and that's the real heartache that we have.

The Monorail's opponents were adamant that it would never work as a transport system because the route rarely intersected with other public transport and simply went in a big loop. Furthermore, it wrought aesthetic vandalism on the old precincts of the city. The damage to the city skyline was so ugly there never could be commensurate compensation for these critics. The Monorail's desecration of the old city blenced in many people's minds with what they feared would be an architectural catastrophe at Darling Harbour.

Wran believes that because it was 'a giant-sized development':

It scared people because they were under the impression it would be a conglomeration of ugly buildings with lots of commercial activities. That wasn't the point at all. Some people just never could see the balance that Darling Harbour gave: in the north end of the city, the Opera House and Harbour Bridge, in the southwest end, a junk railway yard. By constructing buildings there, by putting in entertainment, conventions etc you would bring that part of the city to life and also bring to life the worn-out residential areas of Pyrmont and nearby suburbs.

Despite his best efforts to communicate this, opposition to the redevelopment, and to the Monorail in particular, grew stronger, gaining a number of champions in the media, especially at *The Sydney Morning Herald* and on the ABC's local radio station (then 2BL,

1986

Neville Wran retires from political life.

now 702). As Wran reflects, 'from time to time, we'd have nasty brawls with *The Sydney Morning Herald*. They were campaigning against me. With time it got worse and they wrote very nasty editorials.'

By 1986 the battle lines were sharply drawn. The Premier's demeanour, if anything, grew harder, as he declared: 'I am bulldozing it through, I am and that's the whole purpose of the exercise.' Wran has no regrets about that stance: 'We didn't allow guerrilla warfare against it. Once we decided that it would be built we brooked no hindrance, and we went ahead and built it as there wasn't a lot of time to do it.'

Laurie Brereton, the minister at the eye of the storm, dusted off his airiazy legendary combative resolve, seemingly revelling in the scorn and vituperation poured on him by the media and the project's opponents.

As Garry Gleeson recalls, though, the whole political climate was turning against the government, with claims of official corruption, especially in the administration of the law, undermining Wran's personal standing. Increasingly, the Premier relied on his minister to defend Darling Harbour. As Gleeson recalls: 'Wran was the Premier, running the state, and continually distracted by the dubious conduct of some senior police and a senior judicial officer, all sorts of problems.'

It was inevitable that Wran's plans for a casino at Darling Harbour would feed this. He had wanted to redevelop the site 'at the same time as the casino', so that there would 'be no need for the government to dip into its pocket because the casino would give us a torrent of gold'.

This was a heaven-sent opportunity for Opposition leader, Nick Greiner, who already had a feather in his cap, having been the first Liberal to take seats from the seemingly invincible 'Nifty' Neville Wran. When the casino proposal subsequently went to tender it ran into trouble. This was inevitable because, as Gleeson says, 'casinos are often not nice places and corruption can develop.'

This seemed to be demonstrated when one of the principals of the first company selected to operate the casino was jailed on an unrelated matter. Then the police refused to give a probity clearance to a shareholder in the consortium that won the second tender. It was a simple matter for the Opposition to promise to abandon the casino, an undertaking it reversed after winning office, building one in nearby Pyrmont. Wran recalls:

The Opposition was scornful. They called Darling Harbour a 'white elephant' that would waste taxpayers' money. They were very critical, but we weren't going to be screwed by our political opponent. We wanted to build something for 1988 and smart footwork by our political opponents probably reinforced our determination to get on with it.

Greiner, however, kept up his simple mantra: Darling Harbour was a waste of public money, which would be better spent on hospitals and other infrastructure. By mid-1986 the political and personal toll of the situation prompted Wran's retirement

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To Wran's amusement, however, 'the unions confounded everybody. They didn't frustrate, they cooperated.' He puts this down to the simple policy of 'treating them properly'.

The Premiership was expected to pass to Laurie Brereton, but instead went to Transport minister and former trade union leader, Barrie Unsworth. While showing he was a capable administrator, Unsworth could not arrest Labor's slide.

When he assumed the Premiership, Unsworth had agreed that Brereton would be left in place to finish the Darling Harbour project. He was also advised, however, that he had to reinvent the government if Labor was to win a fifth term, and this proved to be very difficult with all the controversy raging around the Darling Harbour redevelopment. As a result, Bob Pentecost's job got very hot:

The political environment was severe. We were coming up to an election in March 1988. During '87, Nick Greiner made it very clear that Labor would get no kudos out of Darling Harbour, which he rubbished endlessly. He put a lot of energy into saying how bad everything was and the media picked it up. If he wanted any sort of airplay on the ABC or in the Herald, all he had to do was bag Darling Harbour. It was a terribly difficult environment to operate in. Anything I put in writing I had to assume would be on the front page of the Herald the next day.

Although Pentecost bears no malice towards Greiner, who was only doing his job to win office, he remembers Greiner's rhetoric: 'And what will we do with the windswept empty canyons of Darling Harbour after the Bicentenary?'

Throughout this, Public Works minister Brereton doggedly stuck to the task and, as Wran says: 'He's a tough cookie. You could say: "Knock down a wall" and he'd get a hammer and knock it down. He saw it through the hard times.'

These endless brawls with Greiner and the media over Darling Harbour and the Monorail also took their political toll on Laurie Brereton. In late 1986 Premier Unsworth raised with Brereton the need for changes to the Darling Harbour design, suggesting that a component of public housing might be a circuit breaker. Brereton could not be convinced and he became a major aggravation to the Premier, whose strategy was to run at the 1988 election on a platform of gun control and cracking down on crime.

As Gleeson remembers, Brereton 'became the butt of Greiner's political attack' and internal Labor Party polling 'showed that Laurie was a negative for the government. This was coming through about October to November '87, to the point where Unsworth decided he would move Laurie.' Brereton was extremely reluctant to relinquish the job and declined Unsworth's offer to take the Mines portfolio, insisting he should go straight into Transport and not wait to take this post until after the election due in March 1988. So at the end of November 1987 Laurie Brereton finished his career as a minister in the New South Wales government, which was greeted warmly by the many opponents he had riled over the years.

Throughout the redevelopment process industrial relations were also a significant concern. Greiner claimed government weakness in the face of militant demands. To Wran's amazement, however, 'the unions confounded everybody. They didn't frustrate, they cooperated.' He puts this down to the simple policy of 'treating them properly', in what could be considered a major industrial relations coup for those days, the Darling Harbour Authority reached an agreement with the Labor Council's John Toohey covering all the unions represented on the site.

Bob Pentecost still had to do many hard industrial yards. He also had to implement 'brand new safety legislation, which we see today as automatic on building sites'. The unions had strenuously pushed for these improvements, but the contracted builders had never worked under them. Pentecost discovered a major problem. The Employers' Federation had been appointed as the Authority's 'industrial relations adviser':

The Employers' Federation had no other objective than to take the unions on at every opportunity. So the very first blue that came up was in my first week and it went to the Industrial Relations Commission. I thought to myself: 'If we have this every week we're never going to build this job.' So I took the Employers' Federation out of the game and ran industrial relations on the basis that if I didn't we'd never get there.

In accordance with the new Act, Pentecost established site safety committees, including union and management representatives, on which the union safety officer, Brian Miller, played a critical role in implementing the new safety laws. Then he formed close relations with the unions 'rather than head-butt them'. The man he became closest to

Ironically, the place of the country's first major strikes became a place of unprecedented cooperation and communication between the workers, the government, the unions and the contractors.

1988

Darling Harbour opens to the public.

was Joe Owens, the communist ex-head of the most militant building union, the Builders Labourers Federation. Owens was the chief site delegate and also represented crane drivers.

Pentecost came to see many safety issues through the workers' eyes and after a series of 'very interesting and strong discussions' he struck a modus vivendi in which:

Joe tended to keep things down to a quiet roar so that I could maybe just live with him. But a lot of the time, he was right. So I formed a relationship with Joe such that no-one would pull the pin and walk off the job before Joe had a chance to talk to me. That's a terrific place to be because it gave us the chance to nose things down before the guys stopped work.

Although Pentecost recalls some close calls during construction, when Darling Harbour opened to the public on 16 January 1988, 'Joe came over. He shook my hand and said: "You bastard, you done it." Not with any animosity.'

It was an immensely proud day for the entire team. Through all the political, media, community and industrial turmoil, they had finally delivered. As Pentecost says:

We knew we were creating something fabulous, something unique and something wonderful that everybody would love. The opponents were knocking it every day because they were ignorant and had a different agenda. And we were going to beat them. We were going to create the goddamn thing in spite of them. It was just a case of keeping that faith and keeping that drive, not worrying about them. They were wrong and we knew they were wrong. It was nonsense, a political game in Macquarie Street. Don't worry about it. Keep driving and delivering, but it was difficult.

A place of celebration

If I'm looking at Sydney as an artist, I cry over the lost opportunities. The harbour really is the thing that recovers Sydney's past bad developments. Darling Harbour is one of those wonderful opportunities which has been given to the people of Sydney – three kilometres of waterfront which people can enjoy and relax in. It's the first time that restaurants and museums, places of entertainment and buildings of a civic nature are being placed on the water so they can respond on a human scale, whereas the major buildings in the Central Business District perhaps lack that human intrigue that we cherish.

Phillip Cox, architect, 1988

In February 1988 Prince Charles and Diana, Princess of Wales visited Darling Harbour. Photograph Hazel Barker

Christmas 1987 was not a happy time for Barrie Unsworth, Neville Wran's successor as New South Wales Premier. Despite his best efforts, both Labor's private research and the published polls indicated that he would not lead the government to a fifth straight election victory the following March. The Darling Harbour redevelopment had not helped, as demonstrated by Laurie Brereton's departure from the Public Works ministry.

There were now just three weeks before opening day on 18 January 1988. Down at the Darling Harbour Authority, Bob Pentecost and his team were not having much of a Christmas, either, as they frantically put the finishing touches to what they hoped would be a triumphant celebration of several years of extremely hard work.

The project would not be completed by then, but enough would be ready to make the day a success. As time ran out in the last few days, Pentecost abandoned the effort to pave the entire promenade area, instead opting to lay temporary coloured asphalt matching the pavers. When the day finally dawned, Darling Harbour was ready for the surge of its first visitors, who prefaced an outbreak of unprecedented activity: a dramatic re-enactment of the arrival of the First Fleet and an armada of Tall Ships from around the world witnessed 11 elegant sailing ships mooring at Cockle Bay as part of the Bicentennial celebrations.

Prince Charles and Diana, Princess of Wales paid public tribute to the success of this transformed urban landscape. Marching bands echoed through Darling Harbour's parks and gardens. In the following six weeks over two million visitors flocked to the precinct to experience a new dimension to Sydney, which for much of the previous four years the critics had said was a planning disaster and would not be finished on time. In defiance of such predictions, among ordinary Sydneysiders and the millions who visit the city each year Darling Harbour rapidly and naturally assumed its place among the city's other waterfront icons.

On Australia Day, 26 January 1988, Darling Harbour played host to a fleet of international Tall Ships, most of which participated in the First Fleet re-enactment.

the Opera House and Harbour Bridge, and became part of the city's culture, establishing itself as a significant Sydney landmark.

In the last hectic months leading up to the Bicentennial celebrations, Bob Pentecost had been so fixated on the final construction details that he had overlooked operational aspects:

I was building the place and hadn't given one thought to what the hell we'd do when we opened. But Stewart Crawford had done a lot of very good work in terms of security, cleaning, maintaining the gardens, uniforms, lot that was needed, getting food and goods in, rubbish out, all that sort of stuff. During 1987 he started to harangue me to focus on it and give him the approvals he needed to start to put this in place, which when I finally woke up, I obviously did. Stewart and his boys worked out all of that and put us through a whole range of operational logistics, all the things that just had to be done and we put them in place.

Pentecost went on to a distinguished career in industry, later returning to the public sector to reorganise the Rail Infrastructure Corporation. He still serves government on the board of Sydney Water.

Pentecost's proudest moment, though, was 16 January 1988:

Simon Dowling was my public relations man and he said to me just before the opening: 'Bobby, are you ready for this?' I said: 'What do you mean?' He said: 'This has been yours for a couple of years. You're Mr Darling Harbour. You're about to open the gates and let the public in and they're going to own this place and they won't give a damn about Bob Pentecost. Are you ready for that?' I said: 'Yes, I think I am. I don't know, but I think I am'.

But it was only when he stood there among the throngs that had come to celebrate on 16 January that:

I understood that I was ready. To me it was such a huge kick. Bang, clang, marching bands playing. There were people wandering about and it was just magic. And then the Tall Ships came in and lined up on the pier and a fellow who I knew, socially – an American, a naturalised Australian – danced up to me and said: 'Thank you, Bob. Thank you for all of this. This is wonderful. This is so fabulous.' And looking at the people enjoying ... good God, just their faces. I was very happy that people did want to own it and did want to take it over. I didn't feel any sense of loss at all.

The politician who had the 'vision splendid', 'Nifty' Neville Wran, is also proud:

I didn't build Darling Harbour brick by brick myself, but I had the privilege of leading the team that decided we'd have this wonderful complex for 1988 and it's turned out to be really successful. What makes me pleased today as I wander around there is to see the families with their little kids running around with their sloppy ice creams, having a ride on the little train that meanders around the park. All in all it's a people's place and it's a place where you can enjoy yourself.

Darling Harbour was built without a lot of heed to the economic rationalist. It was built as a vision, as a place for people. It was built with a breadth of statesmanship, if you like, of Neville Wran saying: 'This is good for the city...'

In 1993 Indigenous performances were held throughout the year at Darling Harbour to celebrate the International Year of Indigenous People.

We probably don't have enough of those sorts of places. There're things that children can be occupied with or get pleasure from, like the water fountain, the inflated castles that let kids jump all over the place. I really get a kick out of that because that's what it's meant to be, it's where people can go and relax, do the shopping if you want to, let the kids loose, near the Aquarium, near the Imax theatre, there're all those things and you can spend a perfectly pleasurable afternoon that'll cost you very little at all.

According to Allen Madden of the Sydney Metropolitan Aboriginal Land Council, Darling Harbour has always played a social role. In the traditional Cadigal language of the Aboriginal people who lived around inner Sydney, Darling Harbour was called Tumbelong (after which the modern park was named). Madden says that Tumbalong was always a place of shelter and good fishing, hunting and gathering. Indeed, the European settlers named it Cockle Bay because of the abundance of pipis.

Madden praises the modern Darling Harbour: 'It's a place of friends and family, as with the Aboriginal people. It's a gathering spot and it's changed over the years and will keep changing, but it will always be a gathering place.'

For the first few months of 1988 Pentecost and his team could scarcely believe what occurred at the gathering place they had spent so much time and energy creating:

People walked slowly. They held hands and they enjoyed themselves, like street theatre. It was extraordinary, absolutely extraordinary. During those first weeks and months, Authority staff would actually leave their desks during work time and walk down into Darling Harbour just to be there and to absorb the atmosphere they'd created. We were gobsmacked. It was sensational.

The two key political players who had driven the project, Neville Wran and Laurie Brereton, were out of the limelight by this time. So, too, was Wran's successor Barrie Unsworth, defeated in a landslide at the March 1988 election, as much by his courageous stand over gun control laws as anything else. As Gerry Gleeson recalls: 'So when Darling Harbour was eventually officially opened by the Queen on 4 May 1988, it was done by Greiner as Premier, which is rather ironical.'

For Bob Pentecost and his team it was a rather chilly change to the political landscape. Premier Nick Greiner immediately put a dose of reform salts through the bureaucracy, purging the upper echelons and introducing changes that strictly focused on efficiency and the bottom line of public expenditure. Greiner had spent much of 1987 campaigning against Darling Harbour, so, as Pentecost remembers:

When the regime changed in Macquarie Street it became quite difficult. Darling Harbour was built without a lot of heed to the economic rationalist. It was built as a vision, as a place for people. It was built with a breadth of statesmanship, if you like, of Neville Wran saying: 'This is good for the city. It may not necessarily pour into Treasury's coffers as a tangible dollar that we can see, but it's good for the city. It's good for the people of the city.' Having an open space where people aren't bombarded

Barrie Unsworth, Premier of New South Wales 1986–88, and his wife Pauline, sitting on the logo of First State Inc, the NSW Government's official blueprint to market to the people of its state.

by advertising by McDonald's and KFC and people can stroll, walk arm-in-arm, enjoy street theatre, relax. It's a lung for the city. All of those things were part of the vision, which I learnt by osmosis. And I thought it was all nonsense when I arrived, but I walked away a believer.

Tom Hayson had believed from the beginning. After he won the contract to build the Harbourside marketplace, but before work had begun, Hayson held a lavish promotional function, where he confidently predicted that up to 20 million people a year would visit Darling Harbour when it was finished, but a senior journalist reportedly called out: 'Bullshit. Bullshit!'

In the 21 years since Darling Harbour opened, 300 million visitors have enjoyed it, an average of just over 14 million a year. In 2006 electronic monitoring equipment recorded 26 million people movements into Darling Harbour, and it has been above 25 million a year for several years.

As Pentecost observes, 'tangible dollars' may not have been pouring into Treasury's coffers, but there is no doubt that Darling Harbour is a major economic driver for Sydney, New South Wales and Australia. For example, in 2005 Deloitte conducted a detailed *Economic Impact Study* of the activities of the Sydney Harbour Foreshore Authority, which incorporated the Darling Harbour Authority in 2001. Deloitte established that in the financial year 2003/04, the gross economic impact of the activities conducted within Darling Harbour and the private sector businesses that operate within or depend on the precinct (such as hotels, retailers, bars and restaurants) was just under $4.2 billion ($4.6 billion when escalated to a 2008 value). In other words, Darling Harbour directly and indirectly puts around $4.6 billion into our economy every year.

To place this in some historical context, it should be recalled that in February 1984 New South Wales Premier Neville Wran told a gathering of 14 of Australia's leading developers that it was 'absolutely essential' for Sydney to have exhibition and convention centres as part of the redevelopment of Darling Harbour. Bob Pentecost credits Wran with the vision of what these institutions would contribute to economic prosperity and employment: 'The Convention Centre's done its job in bringing tourists in. What happens with conventioneers is that they leave – I don't know what it is these days – maybe $1000 a day on the floor of the city – in a hotel room or restaurant or a souvenir shop. Wran understood that and he understood that would be a benefit'.

Pentecost's estimate of the average daily spending of those attending conventions at Darling Harbour is in line with a 2001 study which found that each delegate to a convention in Darling Harbour spent on average $749 a day. The contribution of the Convention and Exhibition Centres to the economy has been enormous over the last 21 years. Between them, these two major components of Wran's 'vision splendid' for Darling Harbour have staged well over 10,000 events, including more than 300 major international conventions or exhibitions. In excess of 20 million people attended these events, generating more than $1 billion in direct revenue. It is estimated that more than $6 billion flowed into the economy as an indirect consequence of such activities at the Convention and Exhibition Centres, including international conferences such as Sibos, APEC, Amway China and major medical conferences such as the Gastroenterology and Anaesthesiology conventions, and regular exhibitions such as the Motor and Boat Shows, the Reed Gift Fairs and the Good Food and Wine Shows. The business generated by such events will continue well into the future. For example, based on currently scheduled conventions and meetings, the projected economic benefit generated by direct delegate expenditure in 2009/10 is estimated to be $477 million.

In 2009 Neville Wran's 'vision splendid' is as strong as ever and Darling Harbour remains a place where ordinary people party, celebrate and relax at numerous events, which are all free. This includes 16 cultural festivals every year, which showcase and celebrate music, food, dance and people, reflecting Sydney's cultural melting pot and rich mix of nationalities. Just a few of these include the Indonesian Festival, Thai Grand Festival and Thai Food Fair, Sydney Greek Festival, Indian Festival, Hoopla, the Jazz and Blues Festival, Sparkling Korean Festival, Brazilian Festival, Fiesta, Armenian Festival, Egyptian Festival, Lebanese Folkloric Festival, Sydney Christmas Parade, Polish Christmas Festival, Christmas Carols by the Tree, New Year's Eve, Australia Day Spectacular and the Chinese New Year Dragon Boat Festival.

Crowd dancing in front of the Aquashell floating stage at Fiesta, one of the major events held every year at Darling Harbour.

2009

An estimated 300 million people have visited Darling Harbour since its opening in 1988, most of whom are Sydneysiders.

A place for people: Darling Harbour sparkles against the dramatic cityscape, with thousands of people enjoying an evening concert.

Many would properly argue that it is still too early to pass final judgement on Darling Harbour's place in Sydney's culture. Time will tell if it permanently takes its place with the city's other waterfront icons, the Harbour Bridge, opened 77 years ago, and the Opera House, opened 36 years ago. As Darling Harbour celebrates its 21st birthday in 2009, however, it seems more likely than not that history will judge that it is an equally successful and permanent part of Sydney's cultural identity.

As Allen Madden says, Darling Harbour has also changed a great deal since 1988. There have been many significant additions in the last 21 years, including four hotels (Nikko, Novotel, Parkroyal and Metro Inn), the IMAX 2D and 3D cinema with the world's largest screen, the Cockle Bay Wharf with its expanse of top-class restaurants, bars and entertainment facilities, the expansion of the Convention Centre and the Sydney Attractions Group's Wildlife World.

These additions have increased the facilities for visitors, who can now shop at 61 stores, eat at more than 100 restaurants, enjoy 32 attractions and visit 19 heritage-listed sites, including the Pyrmont Bridge, the Chinese Garden of Friendship, Cockle Bay and Pier Street Archaeological sites, the Corn Exchange, the Hunter River Steamship Navigation Company office and the Hydraulic Pumping Station.

The Monorail – that pre-eminent symbol of the campaign against Wran's vision – celebrates 21 years of operation in 2009, along with Darling Harbour. Although passions have subsided, many remain convinced that it desecrated the Sydney skyline, especially the older architecture of the city. Yet the Monorail has become a major tourism attraction, with between two and three million passengers a year using it to both sightsee and travel into and out of Darling Harbour to shop, eat at restaurants and go to the cinema. Of the people who use the Monorail, about 20 per cent are regular commuters, while the rest are split evenly between domestic and international visitors.

The Monorail is privately owned and run by Metro Transport Sydney, which also operates the Metro Light Rail. In these days of global warming, it proudly proclaims that both networks provide clean, green public transport. It is also proud that its operations run at a profit with no government assistance, a rarity among privately-operated public transport systems.

Despite Darling Harbour's impressive achievements in its first 21 years, some still believe that it is, in essence, just a modern 'bread and circuses' attraction for the masses, and that some public housing should have gone into the area together with more parklands. Anyone who has attended Darling Harbour on New Year's Eve cannot doubt that the masses are very happy down on the water enjoying Neville Wran's Bicentennial gift to the people.

It is not just the hoi polloi who have embraced the precinct. Darling Harbour and its many features have received 15 major awards over the years, beginning before it even opened when in 1987 the Regal Gardens received an Excellence in Construction award. In 1989 Philip Cox's Exhibition Centre won the prestigious Sulman Award for architecture and the Chinese Garden was awarded an Excellence in Construction award. In 1991 the entire precinct won the Waterfront Development Award and throughout the last two decades Darling Harbour's features have continued to win major awards for tourism, exhibitions, retail excellence, water conservation, environmental initiatives and corporate social responsibility.

Many would properly argue that it is still too early to pass final judgement on Darling Harbour's place in Sydney's culture. Time will tell if it permanently takes its place with the city's other waterfront icons, the Harbour Bridge, opened 77 years ago, and the Opera House, opened 36 years ago. As Darling Harbour celebrates its 21st birthday in 2009, however, it seems more likely than not that history will judge that it is an equally successful and permanent part of Sydney's cultural identity.

Darling Harbour's water fountains and features were designed to complement the surrounding buildings. Many visitors enjoy an irresistible urge to dip their bodies and dip a toe in the fast running waters. Photograph by Matthew Vasilescu.

Acknowledgements

Shelly Rowell, Special Project Officer, Sydney Harbour Foreshore Authority, conducted a series of oral history interviews which are reflected in the text, with Neville Wran, Garry Gleeson and Bob Pentecost, and carried out intensive research for this publication.

Quotes preceding Chapters One (Phillip Cox), Two (Professor John Haskell) and Five (Phillip Cox) are all from *The Listening Room*, ABC FM, 28 March 1988 (Producer: Robyn Ravlich).

Martin Millspaugh, *The Sydney Story: Darling Harbour*, http://www.globalharbors.org/sydney_darling_harbor.html

Wayne Johnson and Roger Parris. 2008. *A History of Sydney's Darling Harbour*, Sydney Harbour Foreshore Authority, Sydney.

Kevin Perkins. 2001. *Dare to Dream: The life and times of a proud Australian*, Golden Wattle Publishers, Sydney, on the life and times of Tom Hayson, provided many historical details without which this text would have lacked authenticity.

Darling Harbour Authority film, *A Challenge Accepted*, 1990.

Sydney Harbour Foreshore Authority film, *Celebrating Darling Harbour's 21 Years*, 2009 (Producer: Shelly Rowell).

Who's who of Darling Harbour

DARLING HARBOUR AUTHORITY BOARD – 1984 to 1988

Chairman – Mr Alexander Carmichael
General Manager – Mr Robert William Pentecost
General Manager – Mr Hank Christian Laan (to Sept '85)
Mr Laurie John (Jack) Ferguson
Ms Margaret (June) McCallum
Mr John Joseph David
Mr Gennaro (Jim) Abignano
Mr Gregory Francis Coote
Mr Trevor John Kennedy

DARLING HARBOUR AUTHORITY SENIOR STAFF – 1984 to 1988

Mr Stewart Crawford, Deputy General Manager (Development and Operations)
Mr John Starkey, Deputy General Manager (Finance and Administration)
Mr Derril Greenway, Senior Project Coordinator
Mr Bill Arkinstall, Financial Controller
Mr Ken Leong, Accountant
Mr Stephen Howard, Senior Administrative Officer
Mr Jeff Bird, Media Services Manager
Mr Simon Dowling, Media Services Manager
Mr Peter Wade, Deputy Director (Engineering and Construction)
Mr Gary Colliton, Deputy Director (Architecture)
Mr Chris Jenkins, Deputy Director (Contracts)
Ms Annette Burden, Marketing Services Manager

Quality Review Committee
Professor Neville Quarry (Chairman)
Ms June McCallum
Mr Andrew Andersons
Mr Geoff Caban
Ms Anne Landa
Mr Ken Woolley

Project Design Directorate
MSJ Group – Director, Mr Barry Young

Managing Contractor
Leighton Contractors Pty Ltd – Project Manager, Mr Tony Spink

Land and Marine Services
Contractor – Barclay Mowlem Construction Ltd

Roads, Pedestrian Overpass
Builder – NSW Government
Design – MSJ Group, Sinclair-Knight
Principal Contractor – Roberts Construction Ltd

Tumbalong Park
Builder – NSW Government
Design – MSJ Group, Mitchell & Clouston
Principal Contractor – Roberts Construction Ltd, P Ward Civil Engineering

Chinese Garden
Builder – NSW Government
Design – Guangdong Provincial Government
Contractor – Stuart Brothers Pty Ltd
Supply – Civic Trees Pty Ltd

Pyrmont Bridge Restoration
Builder – NSW Government
Design – Hughes Trueman Ludlow Pty Ltd
Principal Contractor – Costain Australia Ltd

Harbourside
Builder – Hayson Group (Merlin International Properties)
Architect – Clark Perry Blackmore/RTKL
Principal Contractor – White Industries Ltd

Exhibition Centre
Builder – NSW Government
Architect – Cox, Richardson & Taylor
Principal Contractors – KB Hutcherson Pty Ltd, Allco Steel Corporation, Barclay Bros Pty Ltd

Convention Centre
Builder – NSW Government
Architect – John Andrews International
Principal Contractor – Baulderstone Hornibrook Pty Ltd

Monorail
Builder – TNT
Design/Project Manager – Gutteridge Haskins & Davey
Principal Contractors – Ford Civil Contracting, Roberts Construction, Saipen Allco Joint Venture, Von Roll-Habegger

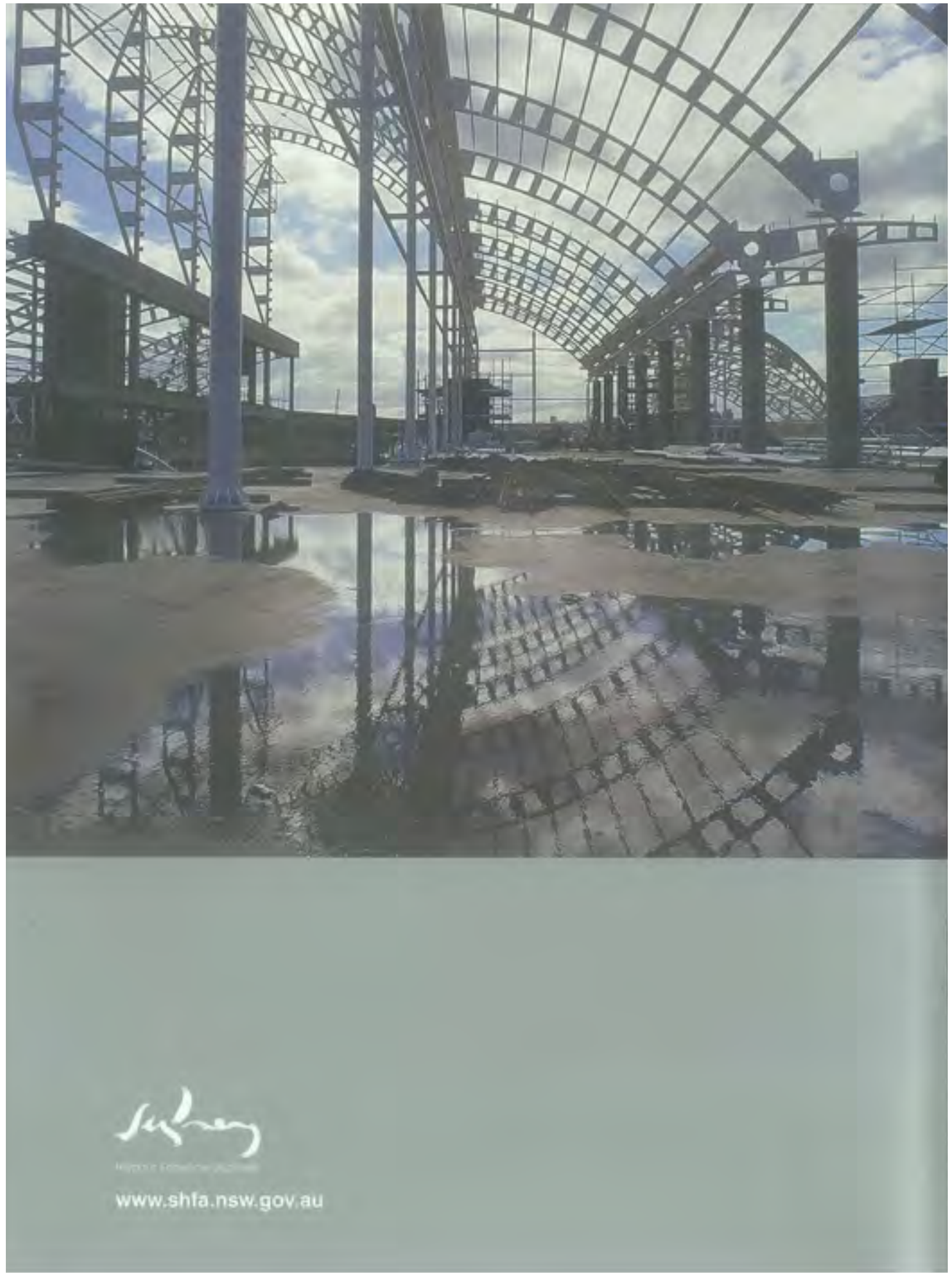
Waterfront Promenade
Builder – NSW Government
Design – MSJ Group, MacDonald-Wagner
Principal Contractors – Citra Constructions Ltd, Costain Australia Ltd

Aquarium
Builder – Jonray Pty Ltd
Design – Cox, Richardson & Taylor
Principal Contractor – Richard Crookes & Associates

Maritime Museum
Builder – Commonwealth Government
Architect – Cox, Richardson & Taylor
Contractors – Costain-Pearson Bridge, KB Hutcherson Pty Ltd, Allco Steel Corporation

Site Services
Builder – NSW Government
Design – Gutteridge Haskins & Davey
Principal Contractors – RJ Brady & Co Pty Ltd, The Hornibrook Group, Roberts Construction Ltd

Back cover: In 1991, the Australian National Maritime Museum – the last attraction of the original plan – was opened, along with four new hotels.


www.shfa.nsw.gov.au

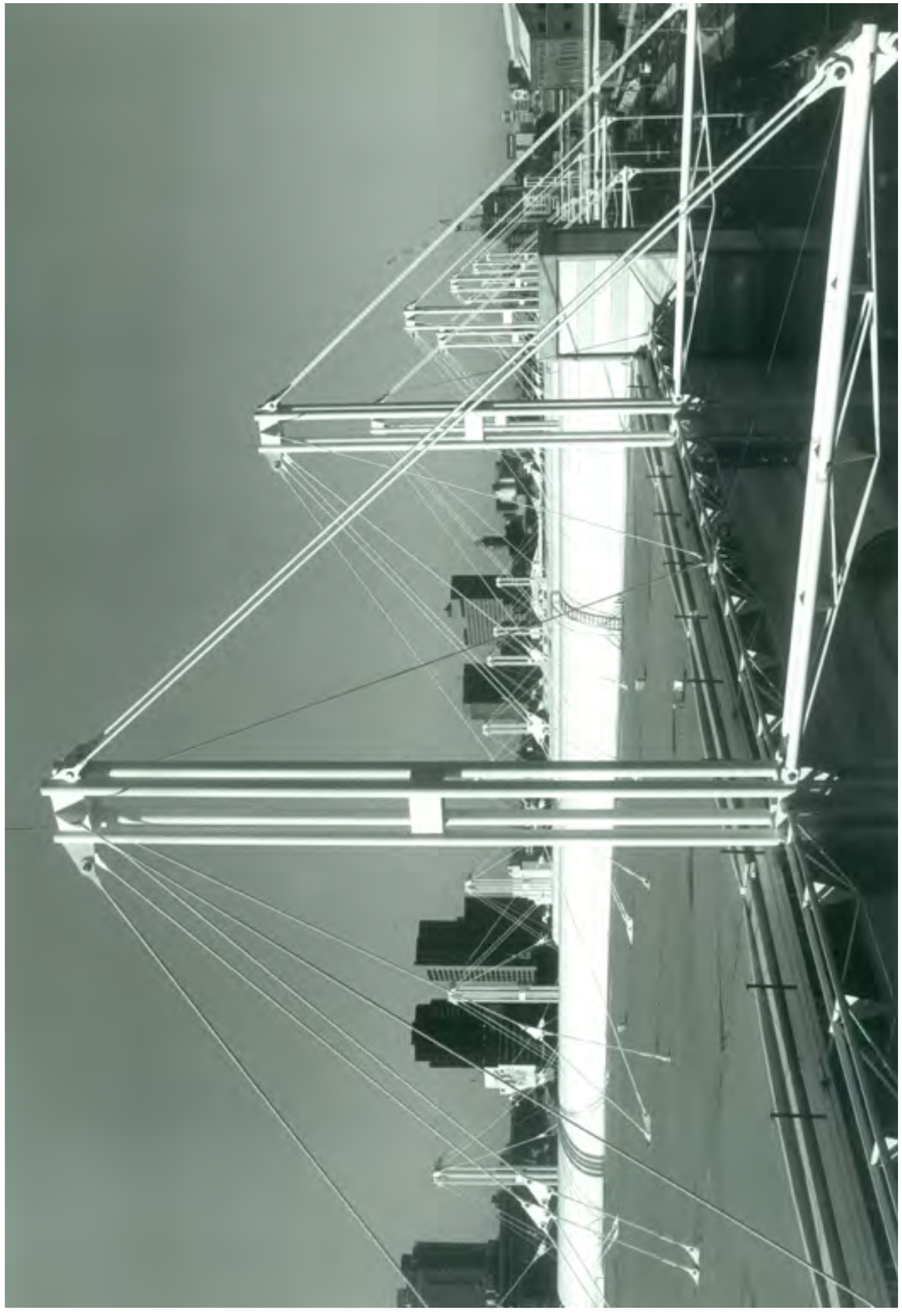
AIA AWARD

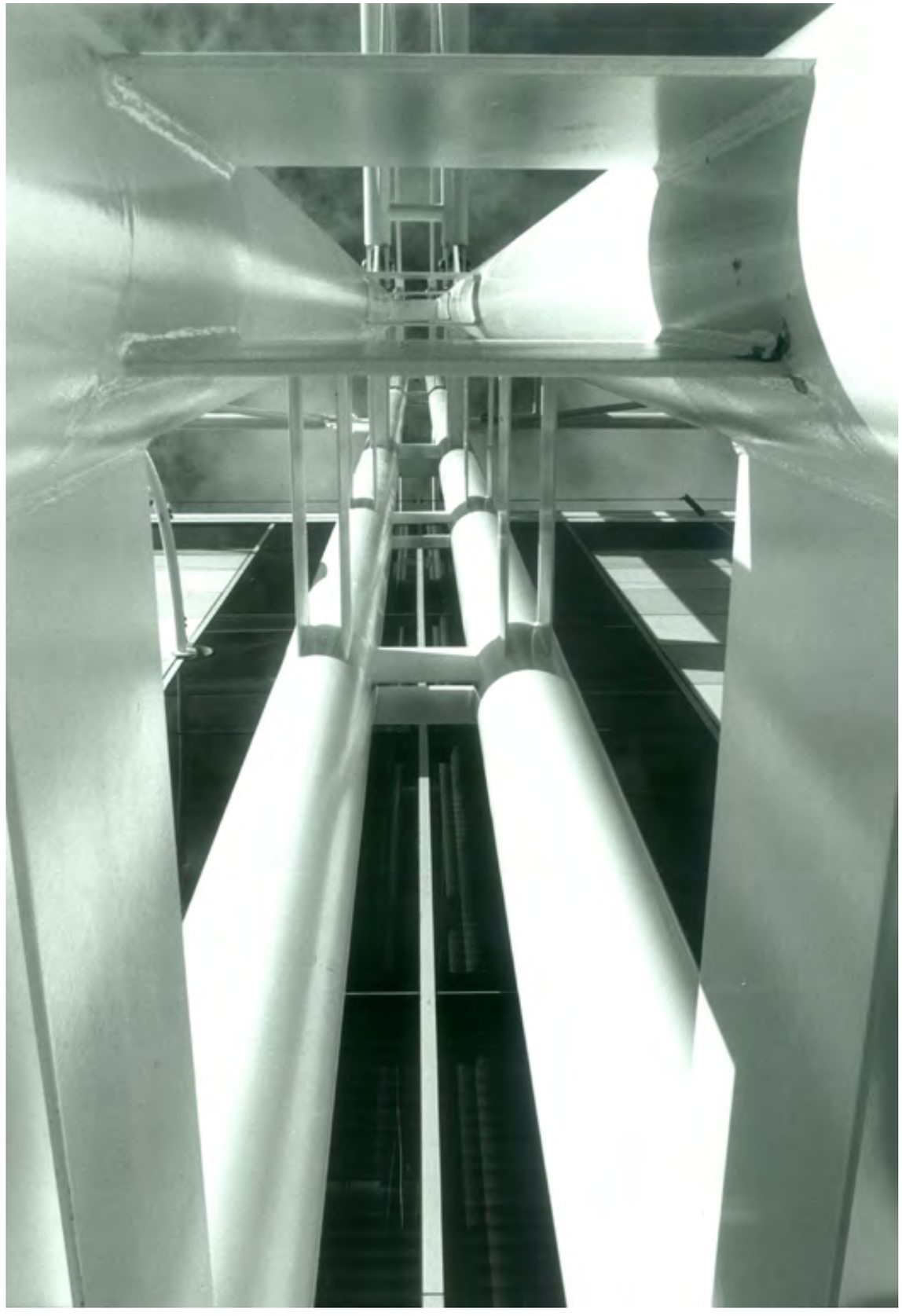
Enduring Architecture

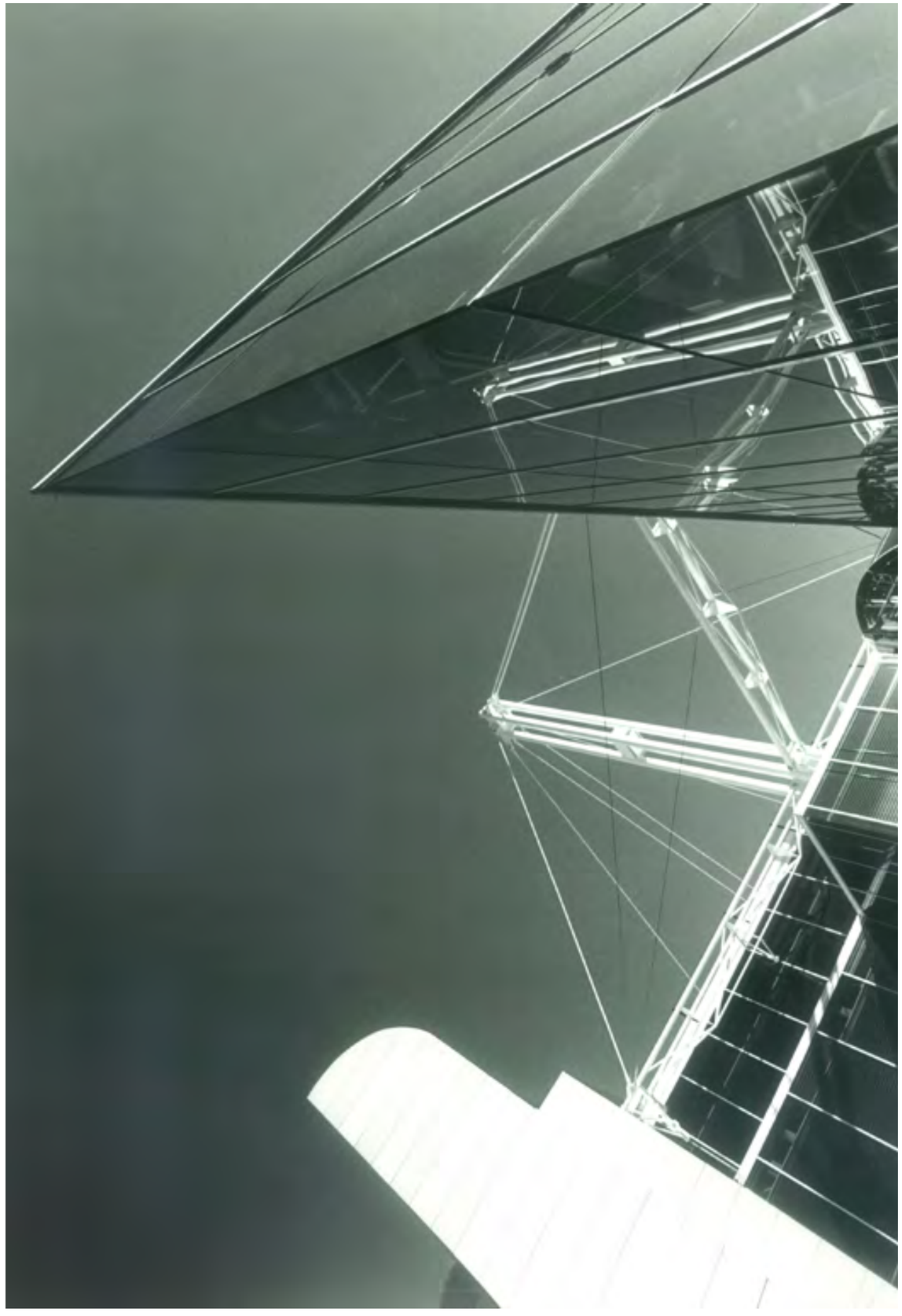
COX **CATEGORY | ENDURING ARCHITECTURE**

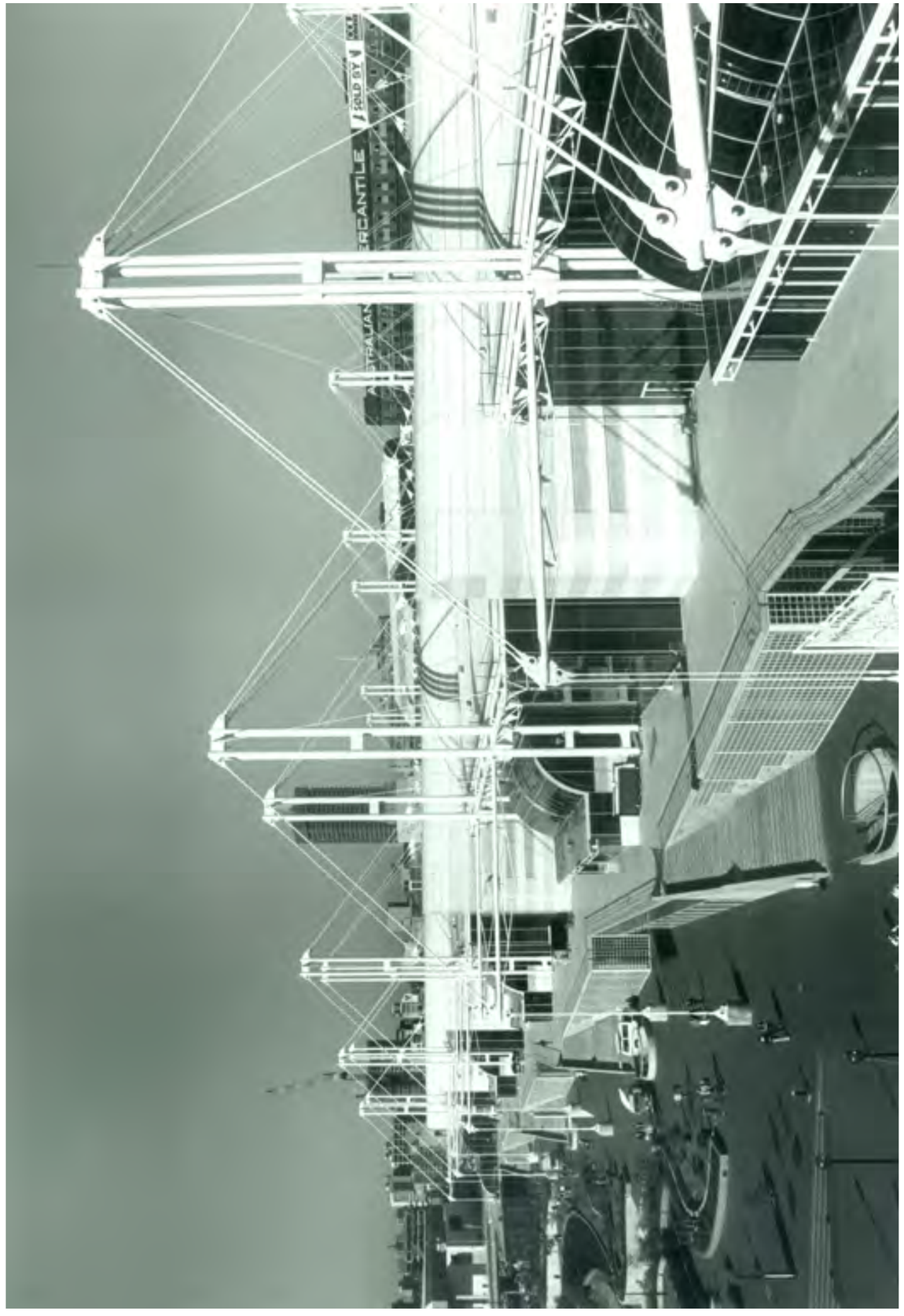
SYDNEY CONVENTION EXHIBITION CENTRE

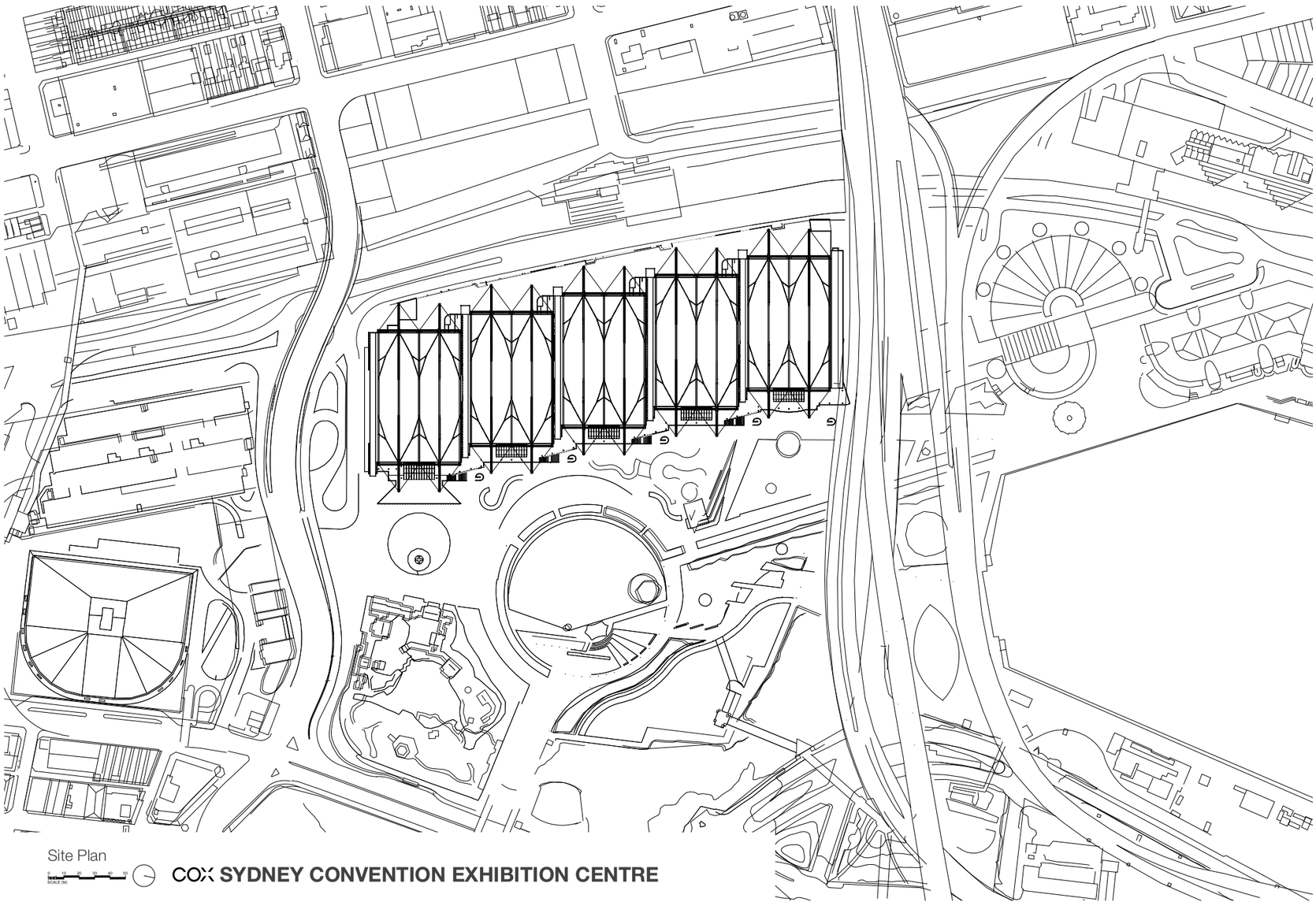
Location	Darling Harbour, Sydney NSW
Architects	Cox Richardson
Contractor	Leighton Contractors
Consultants	
Civil Engineer	Ove Arup
Structural	Ove Arup
Mechanical	AECOM
Electrical	Addicoat, Hogarth and Wilson
Communications	Addicoat, Hogarth and Wilson
Acoustic	Peter Knowland
Quantity Surveyor	WT Partnership
Interior	Cox Interiors





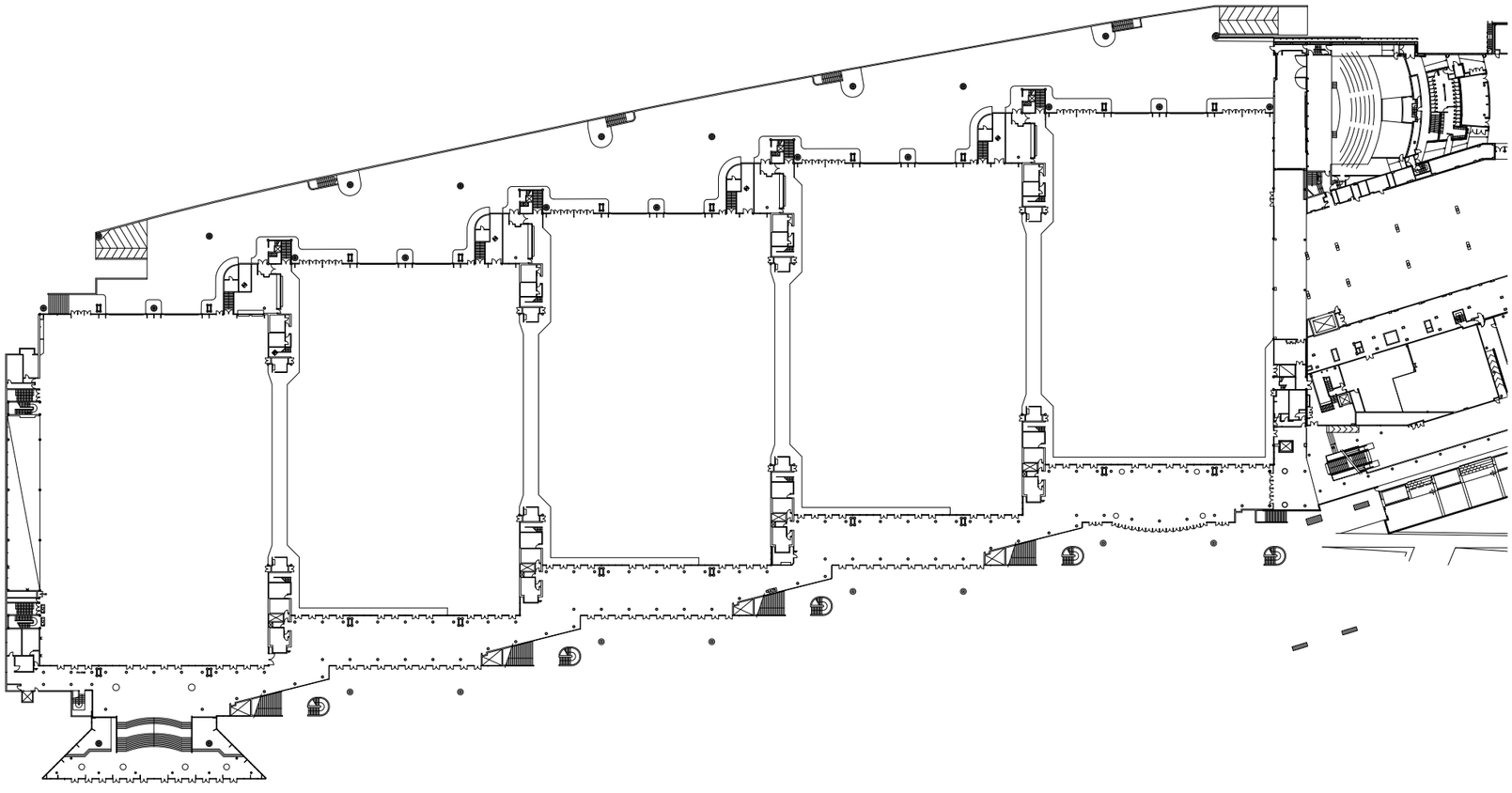






Site Plan

COX SYDNEY CONVENTION EXHIBITION CENTRE

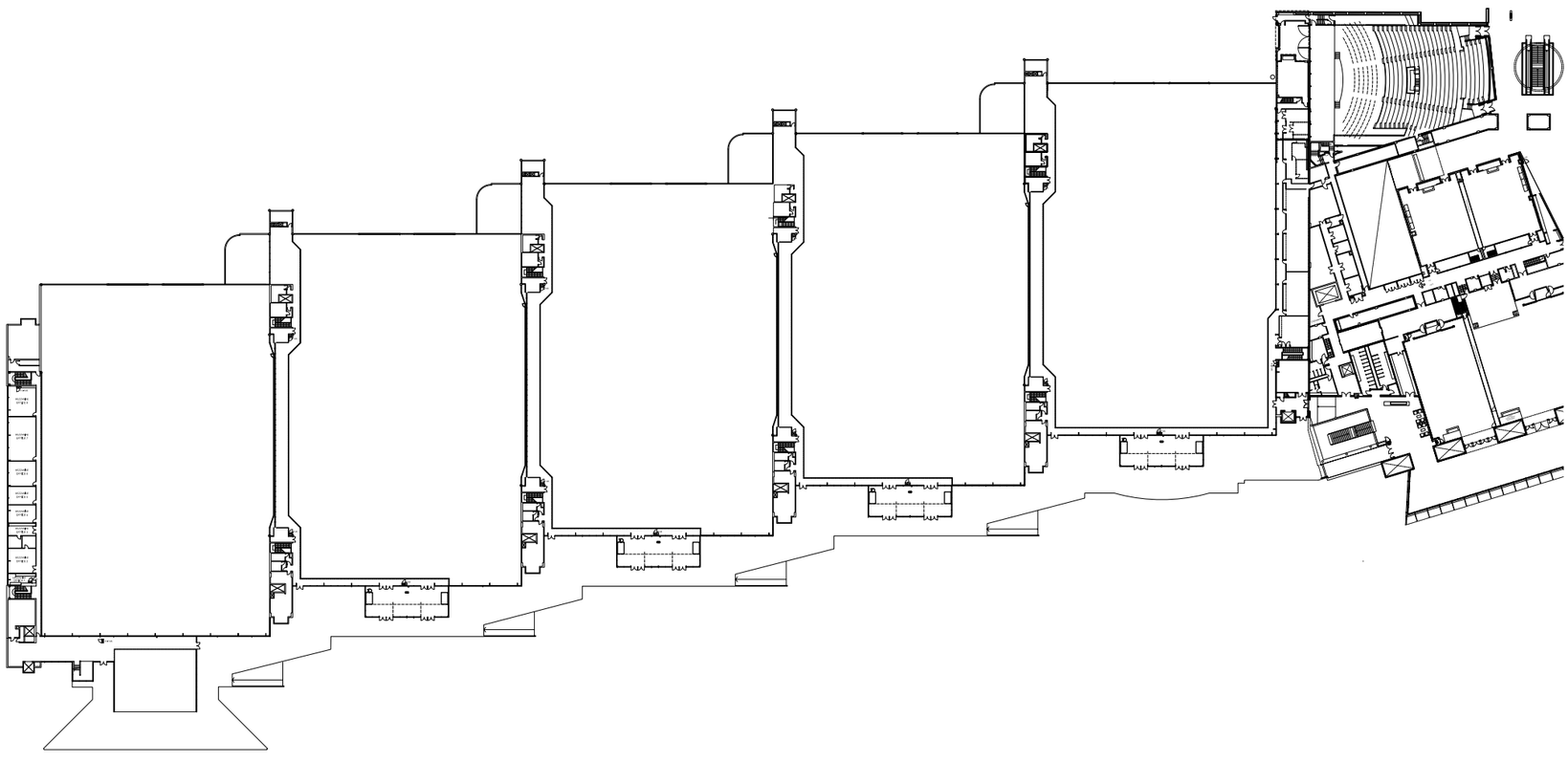


Ground Floor Plan

0 10 20 30 40 50

SCALE (M)

COX SYDNEY CONVENTION EXHIBITION CENTRE



Mezzanine Floor Plan

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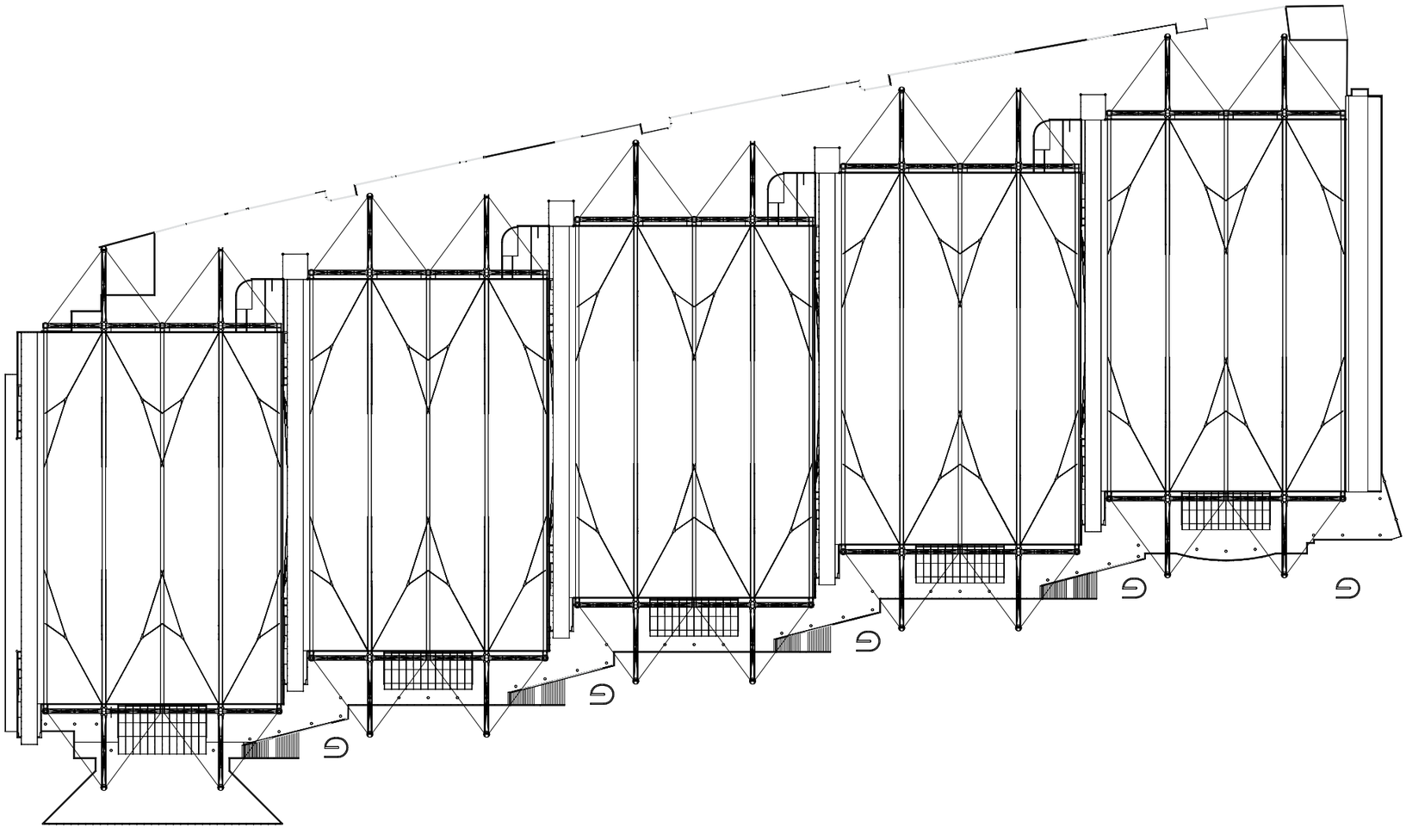
SCALE (M)

COX SYDNEY CONVENTION EXHIBITION CENTRE



Roof Plan

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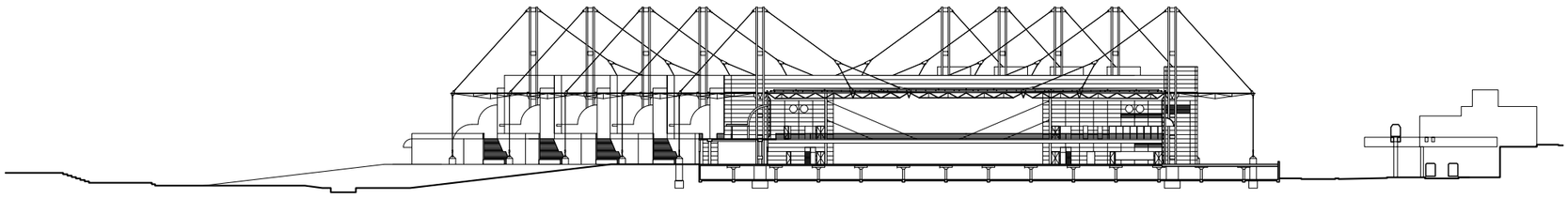
SCALE (M)

COX SYDNEY CONVENTION EXHIBITION CENTRE



Section (Hall)

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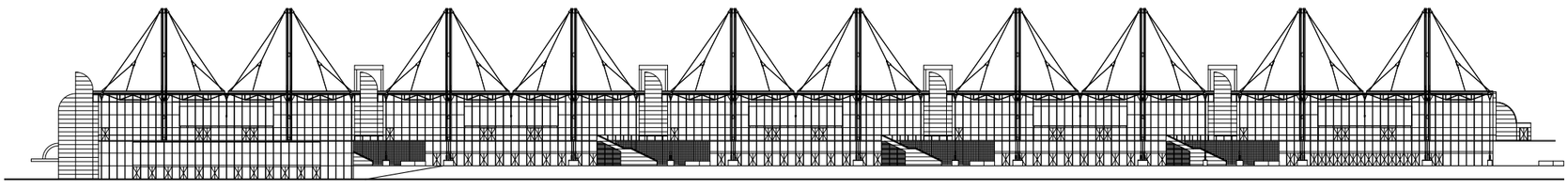
SCALE (M)

COX SYDNEY CONVENTION EXHIBITION CENTRE



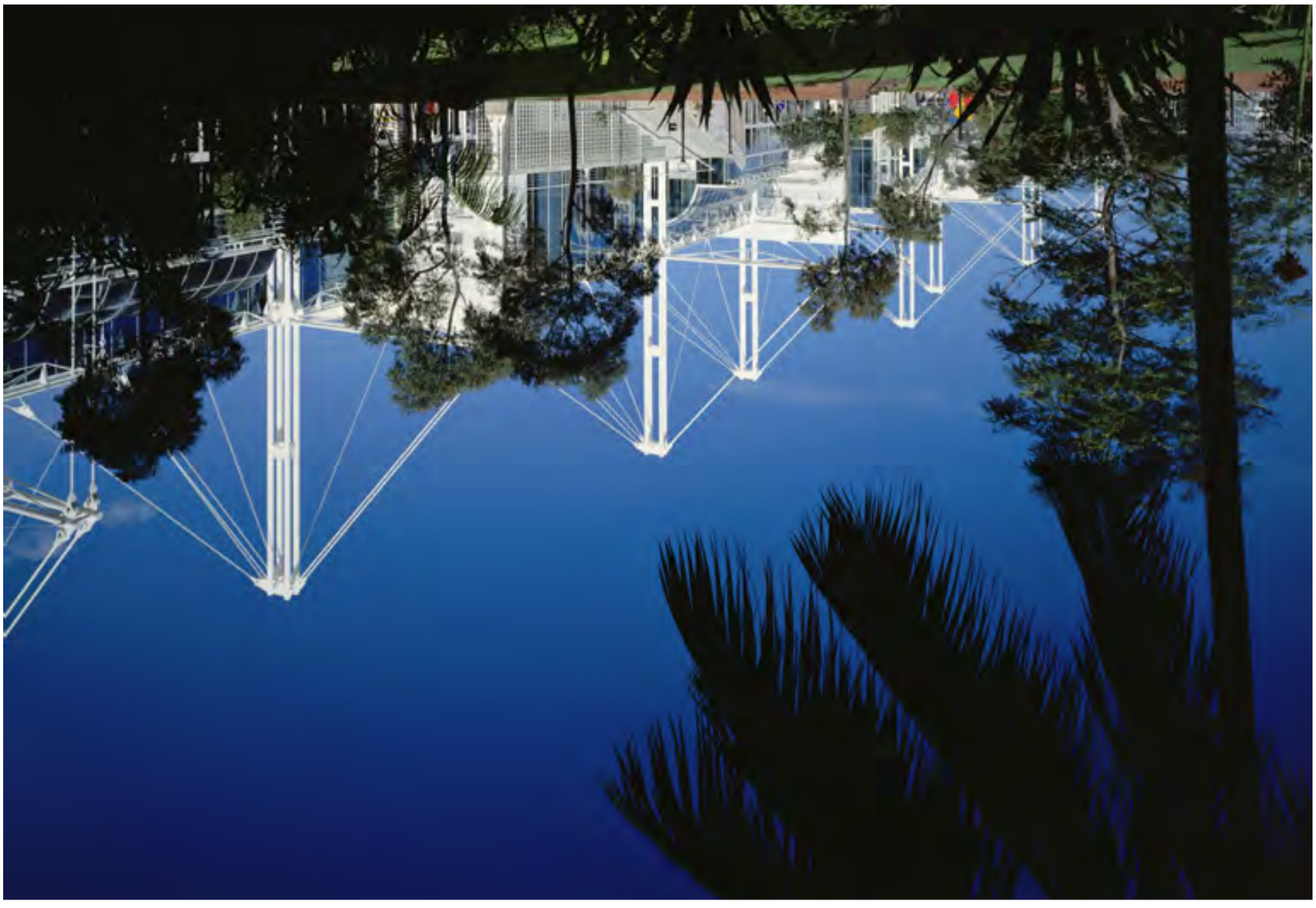
Elevation (Front)

0 10 20 30 40 50

SCALE (M)

COX SYDNEY CONVENTION EXHIBITION CENTRE

IMAGES



Appendix 3
Sydney Exhibition Centre, National Trust Heritage Listing

NATIONAL TRUST

NATIONAL TRUST REGISTER
LISTING REPORT

CITY/SUBURB/TOWN	NAME OR IDENTIFICATION	ADDRESS OR LOCATION
Darling Harbour	Sydney Exhibition Centre	Darling Drive

LGA:	Sydney	ABORIGINAL NATION:	The Eora People of the Cadigal Band
POSTCODE:	2000	LOT/DP:	Lot 900 DP 1132344
COMMITTEE:	Built Heritage Conservation Committee	GRID:	Lat: -33.875 Long: 151.200
AUTHOR:	Anne Higham	LISTING DATE:	

STATEMENT OF SIGNIFICANCE:

The Sydney Exhibition Centre, Darling Harbour, is of high heritage significance as an exemplar of Late Twentieth Century Structuralist architecture. It is an important work in the career of the prominent Australian architect Philip Cox, who continues to play a significant role in Australian architectural history. The Sydney Exhibition Centre is critically acclaimed nationally and internationally as a significant example of Twentieth Century architecture, demonstrating substantial conceptual creativity.

The Sydney Exhibition Centre building was designed in 1985 by the notable architectural firm Philip Cox Richardson Taylor and Partners Pty. Ltd, in close collaboration with internationally renowned engineers Ove Arup and Partners. It was opened in January 1988 as part of the Australian Bicentennial celebrations.
The close design relationship between the Sydney Exhibition Centre, the National Maritime Museum and Sydney Aquarium (all similar structures designed by the same firms) create a coherent civic presence. The development of the precinct was the pre-eminent Australian Bicentennial project and the urban design of the Darling Harbour precinct and brought international focus on Australia and Australian architecture.

The Sydney Exhibition Centre is acknowledged as an aesthetically distinctive design echoing the maritime history of Darling Harbour and was lauded for its innovative use of a long-span masted tension structure. The integrated roof structure and cladding system facilitated minimal use of construction scaffolding and subsequently influenced the design of sports and exhibition facilities worldwide.

The Sydney Exhibition Centre was a finalist in the 1988 World Quaternario Awards and won various national and state engineering awards, such as the National Engineering Excellence Awards in the same year. It was awarded the NSW Institute of Architects Sir John Sulman Medal in 1989 and was a finalist for the Institute's national Sir Zelman Cowen Award. It was extensively published nationally and internationally.

Historical Significance

The Sydney Exhibition Centre, opened on 16 January 1988 by NSW Premier Barry Unsworth, is one of a group of historically significant celebratory buildings associated with the 1988 Bicentennial Celebrations. The building is sited on government land with a maritime history extending back to the First Fleet.

Since 1988 key events were hosted in the Convention & Exhibition Centre including an official State Bicentenary Dinner and the Bicentenary Exhibition. Since then the Centre has been used as the NSW principal

venue for international events and conferences[1]. A highlight being the venue's prime role for the Sydney 2000 Olympic Games, bringing the games to the CBD. It was the venue for boxing, wrestling, weightlifting, fencing and judo with a total seating capacity for over 30,000 spectators.

The Sydney Exhibition Centre is an important work in the career of one of the most prominent Australian architects Philip Cox who is recognised nationally & internationally for his innovative designs. In 1988 Philip Cox, Richardson, Taylor and Partners Pty Ltd produced five major steel structures[2] in close association with engineers Ove Arup and Partners. Three were sited at the Darling Harbour Development, Sydney's major Bicentennial project. The kinship of Cox's three buildings creates a coherent civic presence making a distinguished contribution to the urban design of Darling Harbour. Darling Harbour Redevelopment is one of a group of memorable Bicentennial projects of the New South Wales government of Neville Wran that are historically significant.

Aesthetic Significance

The Exhibition Centre is acknowledged as an aesthetically distinctive design and was a significant technical innovation. Its use of a long-span masted tension structural system established new benchmarks in building design for the construction industry; after 1988 the Cox practice's 'white stadia expressionism' was adopted globally by other architects and influenced the design of international sports and exhibition facilities.

Apart from its structural applicability, the mast and rod formation was intended to have an abstract nautical metaphor, thematically continued in its outriggers, bridges and paneled steel cladding which relates it to original settlement as Darling Harbour was one of the earliest maritime centres in Australia.

It is part of the enduring image of the celebratory function of the Bicentennial and of exhibition. Along with the National Maritime Museum and Sydney Aquarium the Exhibition Centre creates a civic presence and makes a distinguished contribution to the design of Darling Harbour.

In 1989 the Sir John Sulman Medal acknowledged the building's exemplary design for its period. In the same year it was a finalist for the Institute's national Sir Zelman Cowen Award. It was selected as a finalist in the 1988 World Quaternario Awards and various national and state engineering awards, such as the National Engineering Excellence Awards in the same year.

The Sydney Exhibition Centre's importance in the course of NSW's cultural history is primarily derived from its continued use for nearly a quarter of a century as the principal NSW venue for events, exhibitions and conferences. In this role it has been a major contributor to commercial development in New South Wales.

The Exhibition Centre is one of a suite of Bicentennial and Olympic projects that brought an international focus to Australia and Australian architecture.

Internationally it is recognised by the architectural and engineering professions as an important contributor to Australian and international architecture. The concentration of attention on Australia and Australian national identity in the late 1980s was driven by the Bicentennial and was a major opportunity for Cox's work to be seen on a large scale, both through television coverage and in publications, including.

- three COX projects are featured in the revised edition of Dennis Sharp's book *Twentieth Century Architecture: a Visual History* - this European text assisted in making COX's 'white steel' work influential around the world. Sir Bannister Fletcher's *A History of Architecture* featured the Bruce Stadium, the Sydney Football Stadium and Cox's three Darling Harbour buildings in its 20th Edition (1996), bringing the works into one of the most well-known contemporary architectural texts;
- the Bicentennial also brought cultural attention to Australia - the October 1988 edition of the London-based *Architectural Review* was an 'Australian special' which included an article on Cox;
- Jennifer Taylor's *Architectural Review* article 'Philip Cox's Bicentennial Buildings for Sydney' features the Sydney Exhibition Centre, the Sydney Football Stadium and National Tennis Centre extensively, but also both key buildings at Bruce, completed up to 10 years earlier;

[1] For example Sydney Convention and Exhibition Centre was a key meeting venue of APEC Australia 2007 when the political leaders of the 21 member states of the Asia Pacific Economic Cooperation met.

[2] The Sydney Football Stadium, the National Tennis Centre Melbourne (with Peddle Thorp & Learmonth), and the Exhibition Centre, the National Maritime Museum and the Sydney Aquarium.

- the Sydney Exhibition Centre has been recognised by Jonathan Ochshorn in his essay on the history of technical innovation in steel construction in *Encyclopedia of Twentieth Century Architecture,* ed. Fitzroy Dearborn, 2003;
- Alan Blanc, Michael McEvoy & Roger Plank's *Architecture and construction in steel Part 6* includes Cox's Sydney Exhibition Centre and Sydney Football Stadium as examples of 'outstanding contemporary steel architecture'.

The design for the Centre was developed in close collaboration with internationally renowned engineers Ove Arup and Partners, who provided structural and life safety engineering services.

A highly efficient structure, the building was erected in a very short period of time. The integrated roof structure and cladding system allowed for easy and safe erection with minimal scaffolding and the building established new standards for fire engineering and fire safety minimising materials and energy requirements.

Research into crowd behavior and fire loads helped establish rational and economic approaches that have benefited many projects since and led to the alternative solution principles of the current codes.

The project delivered a low cost solution using advanced engineering. Construction cost was on budget and was less than $1,500 per square metre.

The innovative light weight structural and life safety solutions minimised materials and energy requirements for the project. Conventional building regulations in force at the time prescribed a heavy weight, highly serviced building to meet load and life safety requirements.

The structural steel design set new benchmarks for the industry. Estimated steel tonnage savings for the stayed solution were in the order 25%.

Social Significance

The Bicentennial projects brought major international focus on Australia and Australian architecture and contributed to the architectural profession's sense of identity. The Sydney Exhibition Centre is valued by both engineers and architects because of the esteem in which the Sulman Award and National Engineering Awards are held. The SEC is a notable development in the design of long-span masted steel structures recognised internationally by the architectural and engineering communities as an important contributor to world and Australian architecture.

Technical/Creative Significance

The structural system for the Exhibition Centre established new benchmarks in long span building design, the Cox practice's 'white stadia expressionism' after 1988 was adopted by other architects and became influential in the design of international sports and exhibition facilities.[3]

Rarity/Representativeness Significance

The design of the Sydney Exhibition Centre demonstrates technical innovation in the design of long-span masted tension structures. It provides evidence of the enduring image of the celebratory function of the Australian Bicentennial and of exhibition. The kinship of the three Cox buildings, the Exhibition Centre, the National Maritime Museum and Sydney Aquarium created a coherent civic presence and makes a distinguished contribution to the urban design of the Darling Harbour, rare evidence of the creation of a

[3] Many of the new Olympic venues relied substantially on the techniques of steel construction which in 1980s had an aesthetic appeal associated with an emerging Australian architecture. "Steel elements can be fabricated off-site, reducing construction time and effort and allowing precise tolerances. The tensile qualities of steel make it suitable for covering large areas with suspended or stayed structures, and steel trusses and space frames also permit large spans with few points of support. These practical advantages have asserted themselves across the Homebush site, and follow the tenacious arguments mounted by Philip Cox in the 1980s that, first and foremost, the obvious should be addressed. Cox refigured many Olympic buildings in the first major venue to be completed, the Sydney Aquatic Centre, and in his earlier Sydney Exhibition Centre at Darling Harbour. Steel-stayed, trussed or bowed – has emerged not as the preferred method of large-scale construction but as the only method of construction" Harry Margalit, "Identity and the Olympics"

place of celebration valued by the community. (Refer to comparative long-span masted tension structures attachment)

> *If I'm looking at Sydney as an artist, I cry over the lost opportunities. The Harbour really is the thing that recovers Sydney's past bad developments. Darling Harbour is one of those wonderful opportunities which has been given to the people of Sydney – three kilometers of waterfront which people can enjoy and relax in. It's the first time that restaurants and museums, places of entertainment and buildings of a civic nature are being placed on the water so they can respond on a human scale, whereas the major buildings in the Central Business District perhaps lack that human intrigue that we cherish.*
>
> Philip Cox, architect, 1988

The Sydney Exhibition Centre is an excellent example of 1980s steel architecture outstanding because of the esteem in which it is held; it was a significant variation in the design of long-span masted tension structural systems which was subsequently adopted by Australian architects and has had global influence. It is part of a group of buildings referred to in Apperly's "Identifying Australian Architecture" as illustrating late twentieth century Structuralist architecture. (Refer to Comparative late twentieth century Structuralist Steel buildings attachment).

DESCRIPTION:

The Sydney Exhibition Centre comprising five interconnected halls, each of 5,000 square metres, with an underground 1,000 space car park is one of three public buildings undertaken by Cox Architecture in the Darling Harbour Redevelopment Area, adjacent to Sydney's CBD.

The Exhibition Centre is a major component of South Darling Harbour, framing Tumbalong Park along its west edge. It is raised on a podium to overlook the park and articulated so that it is possible to view the park from within as well as to obtain views to the inside of the Centre from the park.

The Exhibition Centre is stretched in staggered formation along the western edge of the Darling Harbour Park from freeway to freeway. Virtually its entire park face is glazed, broken only by the set backs which identify each of its five 5,000 square metre halls. Each hall can be closed off from its neighbour by mechanically operated sliding walls.

Despite its close relationship to the garden context, the horizontality of the building repeats the form of the wool stores and warehouses of Ultimo behind, reinforced by the silhouette of the vertical masts. In order to preserve the garden elevation as a public interface between park and exhibition, the rear elevation is entirely devoted to docking and service facilities and these appropriately face the historic warehouse district of Ultimo.

The concept for the centre arose from four objectives.

- the first was to continue the tradition of structurally innovative exhibition centres dating back to Joseph Paxton's steel, wood and glass Crystal Palace in London.
- the second was to establish an integral relationship with a new park stretched along one frontage.
- thirdly, it sought to convey a distinctive maritime theme conducive to a historic harbour port.
- finally it needed to achieve 100 metre spans without creating a massively scaled edifice.

These objectives were met by a continuous mast and cable structure, proving to be both economical and to allow a low horizontal scale to be developed. The mast and cable structure is anchored within the service zones between each hall and supported by trussed outriggers cantilevered off each main mast. The division of the vast footprint into five distinct sections allowed the building to be operated effectively, as well as mediating its great mass.

It also met the political objective of completion in time for it's for opening in January, 1988 as a key part of the Bicentennial celebrations. From concept design, the entire project took 32 months to complete under a "Fast Track" contract.

HISTORY:

According to SHFA it is difficult to judge whether the Sydney Exhibition Centre site would have had any Aboriginal occupation. European development of the Darling Harbour occurred by the mid-19th century, when maps and plans indicate buildings on the George Street. The 1853 plan indicates a stream or creek running from George Street across the Darling Harbour railway site some 20 metres north of the street frontage.[4] Such watercourses were often the source of food and water for the Aboriginal people of Sydney. The former swampy areas directly to the north of George Street (now Central Railway yards, Carlton Brewery) drained via creeks such as that indicated in the 1853 plan into Darling Harbour. In the traditional Cadigal language of the Aboriginal people who lived around inner Sydney, Darling Harbour was called Tumbalong (after which the modern park was named.) Darling Harbour itself was known before the 1830s as Cockle Bay due to the extensive Aboriginal shell middens on its shores. It is therefore more than likely that the vicinity of the Exhibition Centre site was at least intermittently visited or occupied by Aboriginal people in the course of gathering food or making camps.

European occupation of the study area occurs by the 1790s, when much of the land in the Pyrmont/ Ultimo peninsula was granted to members of the military. By 1804 John Harris had consolidated much of these holdings into the Ultimo Estate, (Governor King had granted this part of the Ultimo Estate to Harris in December 1803.) In 1830-31 a strip of land along the north side of George Street was sold as town allotments, with buildings indicated to the east of the subject site by 1836. This strip had been built out by 1843, shown on the map of that year. John Harris died in 1838, leaving the Ultimo Estate divided between

[4] Since 1985 the creek runs in a massive triple cell culvert 10 metres by 3 metres.

his brothers, and eventually their families. The complexities of the wills and land transfers meant that the property remained jointly owned by the family until late in the 1850s, although small parcels were often leased. Unlike other areas on the outskirts of the city, including adjoining Pyrmont, Ultimo remained largely undeveloped up to the mid-19th century. The Sydney Railway Company, formed in 1849, approached the Harris family with the prospect of purchasing a strip of seven acres of land for the construction of one mile of railway line joining the Sydney railway terminus near what is now Central Station, with proposed wharfage facilities at Darling Harbour. The proposal was accepted by the Harris family who saw the economic advantages of industrial and port development on the western side of the Harbour. The land was sold in 1853, however, like most international private railway companies, the Sydney Railway Company fell into financial difficulties and was taken over by the NSW Government in 1854. The railway, ultimately connecting Darling Harbour and Parramatta, was opened in 1855. The railway reserve of 1853 follows the current corridor and extended almost to Pyrmont Bridge. A series of cuttings and embankments carried the railway from the Redfern terminus (near Central). At George Street (Broadway) a sandstone bridge, still in existence, carried the street over the railway cutting. The railway cutting here obliterated evidence of any structures that had fronted George Street. At Ultimo Road a bridge carried the railway over the road. Little development occurred in the period of almost 20 years following the opening of the railway. The line divided the peninsula, largely alienating the Darling Harbour shoreline strip of land from Harris Street, a factor which was to influence the development of Ultimo and is still strongly evident today.

Pyrmont Bridge opened in 1857, and it was intended that there should be a rail and bridge interchange or terminus, so that goods could be brought across the Bridge from Sydney (and indeed the Darling Harbour wharves) and thence transported by rail, and vice-versa. By 1870 the NSW rail network had connected to Goulburn and was crossing the Blue Mountains. Disputes between the Harris family and the Pyrmont Bridge Company, along with a decreased demand for wool stores and export from Darling Harbour stymied the proposed development. The railway was rarely used apart from the landing and transport of coal and ballast at Darling Harbour for the railways. The Harris family demanded compensation for the stagnated development and in the 1860s the NSW Government awarded them reclaimed land to the east of the railway in the vicinity of what is now Haymarket, between Ultimo Road and Hay Street. The Government's reclamation of the southern end of Darling Harbour led to the construction, in 1874, of the Iron Wharf. This was the first substantial wharfage on the western side of the Harbour and was conveniently located close to the railway to enable its use.

By 1882 Sydney was linked by rail to Albury, Hay and Dubbo, and after the completion of the Hawkesbury River Bridge in 1889 with the Queensland border. By that time all the major primary production regions of New South Wales had been connected with Sydney, and therefore with the Darling Harbour goods line. Industrial developments from the 1870s onward saw Darling Harbour emerge as an important inter-colonial and international transport and manufacturing centre. Thomas Mort established his NSW Fresh Frozen Food and Ice Company on what is now the site of the Chinese Gardens in 1875, experimenting with refrigeration of meat. Mort also had slaughter yards located over the Blue Mountains at Bowenfels, from where frozen meat was transported by rail to Sydney. In 1879 the first refrigerated shipment of meat left Darling Harbour for England. In 1889 the first refrigerated rail cars were bringing produce from all over NSW to Darling Harbour for Sydney's consumption as well as international export.

The Atlas Engineering Works at Pyrmont was building railway engines and passenger and goods rolling stock from 1878 on land adjacent to the Darling Harbour line. On the city side of the Harbour, engineers Peter Nicol Russell & Co. had been making rolling stock since 1869 in a purpose built factory only demolished in 1985. Livestock was also brought to Darling Harbour by rail for export. An 1888 map of the site indicates animal pens located within and adjacent to the study area south of Thomas Street, still indicated in the 1897 map of the site. The 1888 map also shows a number of buildings concentrated on either side of the railway line at the Broadway end of the site. The three buildings on the western side are gone by 1897 which could suggest they were timber, more or less temporary structures. In the 1880s Goldsborough & Co built a wool store near the railway on the corner of Fig & Pyrmont Streets, accessible not only to the rail but also Harris Street. Other wool stores followed in the ensuing decades, all conveniently located close by the railway. Around this time the railway pushed further into Pyrmont. The Ultimo Power House was built in 1898-99 on the railway line by which it was supplied with coal, as was the Pyrmont Power Station some ten years later. Following the Government resumptions after 1901 and subsequent wharfage developments at Jones Bay and Darling Island, the railway expanded and fostered the industrial boom first predicted in the 1850s.

By the 1910s Darling Harbour south of Pyrmont Bridge was becoming too shallow for large vessels and was largely reclaimed in the late 1920s using fill from Sydney's underground railway excavation. Before this

land reclamation, the harbour extended as far south as Pier Street, which runs between the Chinese Garden and the Entertainment Centre. The Iron Wharf was demolished and operations concentrated further to the north. By this time the subject site had become simply the location of rail lines with no need for buildings associated with the loading or unloading of goods. Thus it was to remain for the rest of the active life of the goods line. Darling Harbour was the major rail-sea goods interchange in New South Wales for nearly a century. By the 1960s many of the wool stores and other port functions were moving out of Sydney. The number of ships using the inner harbour declined – ships were getting bigger, so there were fewer of them. And trains and trucks soon replaced most of the coastal shipping trade. Road transport was often a less expensive medium than rail for transhipment of goods. The functions of the railway decreased significantly.

In 1971 the first assessment of the potential for redevelopment of Darling Harbour was published by the Sydney City Council. It proposed that a park, markets and residential development be built. Studies of the area continued throughout that decade. Finally in the 1980s the Darling Harbour Redevelopment spelt out the final chapter of the Darling Harbour goods yards, which were demolished and redeveloped in 1985-1988.The old wharfs by then too small to accommodate the large new ships-closed down. Port Botany, with its custom-built container terminal became Sydney's major port.

The redevelopment of Darling Harbour, the first maritime centre in Australia, was the centerpiece of the NSW Wran Government's programme for the 1988 Bicentenary. At the time Philip Cox called it "the most important piece of real estate that's been put together in Sydney in 100 years".[5]

On 1 May 1984 Premier Neville Wran announced a highly ambitious plan to rejuvenate Sydney's Darling Harbour. The redevelopment Darling Harbour along the western edge of the city was to be a government backed, transformation of the derelict 54 hectare harbour front site into an inner city entertainment area - a new "place for people." Neville Wran's vision for Darling Harbour was part of his wider philosophy of making Sydney accessible to ordinary people, enhancing the culture and general quality of life in New South Wales. The government put in place a massive capital works program for the Bicentenary. It included turning the abandoned Pyrmont Power House into a museum, extending the Australian Museum, the Art Gallery and Mitchell Library, building a better connection between the Opera House and Circular Quay, upgrading the Macquarie Street and Circular Quay precinct, renovating Hyde Park Barracks and the Mint, the establishing the Bicentennial Stonework Programme[6], adapting the Maritime Services Board building to create the Museum of Contemporary Art, creating Bicentennial Park, the first major new park since the centenary in 1888. The government also embarked on the biggest road construction program in the state's history.

Darling Harbour was the centrepiece that captured the community's attention. Wran's vision was to create a permanent part of Sydney's cultural identity. He stated that it was 'absolutely essential' for Sydney to have exhibition and convention centres as part of the redevelopment. The significant change Darling Harbour urban renewal brought to the city was public access to the water. It changed the whole pattern of recreation and the way the population used the city. The phenomenon of urban revival and renewal has continued since 1988 and a network of waterfront promenades and parks has continued to make the harbour foreshore accessible.[7]

Bob Pentecost credits Wran with the vision of what these institutions would contribute to economic prosperity and employment. Darling Harbour was not to become an essentially transitory and ephemeral place like World Expo88, Brisbane's contribution to Australia's Bicentenary. Darling Harbour redevelopment was in 1988, 'the largest urban renewal project in the history of Australia'. It had an immediate effect on the surrounding area. Many new privately funded hotels were built and car parks and office buildings were driven by the success of Darling Harbour in providing a new focus for Sydney. There is no doubt that

[5] *'Steel Profile'* No.17 September 1986

[6] "For the first time, issues of preserving the past, as well as planning for the future, were addressed seriously by the state government. . . . The government adopted the fight to preserve historically significant architecture; the Heritage Act was passed ... the Heritage Council created, as was the Historic Houses Trust." Lucy Hughes Turnbull, 'Sydney Biography of a City.'

[7] To the west six km harbour front promenade and open space network stretches from Tumbalong Park and Exhibition Centre in Darling Harbour to Wentworth Park. Along the eastern side of Darling Harbour Cox's lively King Street Wharf extended the 1988 harbour front promenade and the Barangaroo development will potentially link it to the Walsh Bay urban renewal. Excluding the Barangaroo site this represents an almost 50% increase in accessible waterfront between Glebe and Woolloomooloo Bay.

Darling Harbour is a major economic driver for Sydney, New South Wales and Australia. Sydney found popularity as a tourist destination.

The men chosen to oversee the Bicentenary Program, Public Works Minister Laurie Brereton, Gerry Gleeson, head of the Premier's Department and Bob Pentecost, Director of Capital Works, all played a key part in implementing the projects.

A development Strategy, produced by the Public Works Department, was exhibited in December 1984. In 1985, the Darling Harbour Authority (which could bypass City Council controls) was established. The Authority was run for much of its development phase by Chair Alex Carmichael, and Chief Executive Officer, Bob Pentecost. The decision to suspend all planning powers and give the Darling Harbour Authority the sole responsibility for the redevelopment was hugely controversial, fuelling media and community criticism. In addition a Quality Review Committee set up, the MSJ Group was appointed as the "Project Design Directorate", and, unusually for a government funded scheme, Leighton Constructions Pty Ltd, a private firm of contractors, was appointed on 18 December 1984 to provide services in project management, financial and construction programming, administration and supervision. It was a daunting fast track process to enable Darling Harbour to be ready for opening on Australia Day January 1988. The role of the managing contractor, Leighton Contractors, was crucial in bringing the many disparate parts together. They managed 60 firms of consultants. Designing and constructing such a large scale project in just over three-and-a-half years was extraordinarily ambitious.

Architect Richard Dinham, Design Manager for Leighton Contractors interviewed four architectural firms for the design of the Exhibition Centre and the Convention Centre. The design of the Convention Centre design was awarded to John Andrews International Pty. Ltd. Philip Cox and Partners were awarded the contract for the Exhibition Centre; their final Design Proposal was presented in May 1985. The Exhibition Centre was the largest physical component of the Darling Harbour redevelopment and forms an enclosure along the western edge, with the park dominating the outlook from the centre.

The Darling Harbour redevelopment was to become the site of three of Cox's 1988 steel structures. They are integral to the definition of the place creating a public precinct with a maritime feel.

The Sydney Exhibition Centre was the first major exhibition centre to be built in Australia since the Garden Palace, built in 1879 in the Royal Botanic Gardens to commemorate Australia's Centenary. It was destroyed by fire less than 3 years after it was completed leaving Sydney without an international standard exhibition facility for over a century.

The design of the Sydney Exhibition Centre followed a progression of innovative projects out of the Cox Office - buildings of clearly expressed engineering producing an architecture proud and strong - the two stadiums in Bruce ACT, predating (Lord) Richard Rogers first tensile building, and then the township of Yulara, NT, a wonderful mix of traditional and "new" residential design and construction. The Australian predecessors of this structural expression remain the Melbourne Olympic Pool (McIntyre and Borland 1956) and the Myer Music Bowl (Yuncken Freeman 1959), and the Sydney Harbour Bridge.

Key factors contributing to the success of the Exhibition Centre include a clear vision and set of objectives for the total outcome, implementation and ongoing operation, supported by political enthusiasm and funding, a management structure with authority, an unambiguous organisational structure, decisive management and a team working in cooperation. Most importantly, there was a clear recognition of the milestone fact that the opening day of the celebration - 26 January 1988 – could not be moved.

The designers of the Exhibition Centre building responded to that imperative.The structural solution allowed an 'industrialised' approach to the manufacture of the building elements, early construction of the roof allowing work under cover and a systematic approach to the design and commissioning of the essential building services.

The Sydney Exhibition Centre has always been recognised as a proud face of the south sector of Darling Harbour. The north sector is fronted by the Conference Centre, but more overtly by the Retail Pavilion of dubious parentage. The Exhibition Centre building, has stood strong as a western face for the space for the 24 years since its construction.

The Sydney Exhibition Centre was opened on 16 January 1988 by Wran's successor Premier Barry Unsworth. On Australia Day, 26 January 1988 Darling Harbour played host to a fleet of international Tall

Ships, most of which participated in the First Fleet re-enactment. In the following six weeks over two million visitors flocked to the precinct and Darling Harbour rapidly 'assumed its pace among the city's other waterfront icons, the Opera House and Harbour Bridge and became part of the city's culture, establishing itself as a significant Sydney landmark.'

Unsworth was defeated in a landslide at the March 1988 election. Gerry Gleeson recalls: 'So when Darling Harbour was eventually officially opened by the Queen on 4 May 1988, it was done by Greiner as Premier, which is rather ironical.'

Since 1988 a new building linking the Exhibition Building and Convention Centre was added for the 2000 Olympics. During the Sydney Games the Exhibition Building and Convention Centre was the biggest Olympic venue outside Homebush. It was used to host the boxing, fencing, judo, weightlifting and wrestling competitions.

In the late 1990s, more visitors came to Sydney because of conventions held at the Exhibition and Convention Centre than any other city in the world. The Exhibition Centre houses the largest column-free exhibition space in Australia, with an open area equivalent to about five football fields. Since Darling Harbour opened, over 300 million visitors have enjoyed it, an average of over 14 million a year. In 2008 electronic monitoring equipment recorded 28 million people movements into Darling Harbour, and it has been above 25 million for several years. On weekends, Sydneysiders come to Darling Harbour to have fun or simply stroll around – along with Circular Quay the Sydney equivalent of Barcelona's famous promenade La Rambla.

Modification Dates:
In 1999 a new building by the architects Ancher, Mortlock and Woolley linking the Exhibition Centre and Convention Centre was added to provide sporting venues for the 2000 Sydney Olympics. Cox Architects also undertook alterations to the Convention Centre in consultation with John Andrews, original architect for the building.

Further Comments

Sydney Exhibition Centre received the following awards:

1987	IE Australia – Highly Commended - Building and Civil Design (Roof Structure)
1987	IE Australia Sydney Division Winner - Building and Civil Design (Roof Structure)
1988	Finalist World Quaterario Award
1988	ACEA Special Merit Award
1988	Commendation Building and Civil Design, National Engineering Awards
1989	Sir John Sulman Medal RAIA (NSW Chapter)
1989	Sir Zelman Cowan Award Finalist RAIA
2001, 2003 - 11	Australasia's Leading Meetings and Conference Centre by the World Travel Awards
2008 – 2011	Best Green Initiative Award Events Industry Association of Australasia
2009 and 2011	Green Globe Silver Certification
2010	Australian Event Awards Spice Magazine Best Venue
2011	Silver Certification by EarthCheck
2011	National Award for the Best Meeting Venue for 500 delegates plus by the Meetings and Events Australia

The contribution to Australian architecture of the COX Group has been widely recognised nationally and internationally since its beginnings in 1964 when the practice first received the RAIA Sir John Sulman Medal. In the 1980s the firm was known as Philip Cox Richardson Taylor and Partners Pty. Ltd.

The Sydney Exhibition Centre Design Director was Professor Philip Cox AO B.Arch (Hon 1), Dip T and CP, University of Sydney, LFRAIA, Hon FAIA, FAHA, MRAPI. He was born 1 October 1939 and is one of Australia's most widely recognised and celebrated architects. He commenced practice with Ian McKay in 1963 and formed his own firm Philip Cox and Associates in 1964. The firm has grown to become the Cox Group with around 400 staff. Cox's work appears throughout Australia also in South-East Asia, China, the Middle East, South Africa and Europe.

Philip Cox graduated from the University of Sydney with honours in architecture in 1962. He was a Royal Australian Institute of Architects (RAIA) silver medallist and was awarded the NSW Board of Architects Travelling Scholarship. He graduated from the University of Sydney with a diploma in Town and Country Planning in 1972. He is a Professor of Architecture at the University of NSW and in 2000 received an Honorary Doctorate of Science from that University.

He has received numerous awards in recognition of his contribution to architecture, including the RAIA Gold Medal in 1984, Life Fellowship of the RAIA in 1987 and Honorary Fellowship of the American Institute of Architects in the same year. In 1988 he was awarded the Order of Australia for services to architecture. In 1993 he received the inaugural award for Sport and Architecture from the International Olympic Committee, and was elected a Fellow of the Royal College of Humanities. He is the author of fifteen publications on the history of Australia's towns, housing and architecture.

The Sydney Exhibition Centre Project Director was Peter John Richardson B.Arch., A.R.A.I.A. John Richardson joined Philip Cox on leaving the University of Sydney in 1969 and has been a Director of the practice since 1972. He has been actively involved as a committee member and councilor of the Royal Australian Institute of Architects (RAIA NSW Chapter) and in 1993 was President of the RAIA NSW Chapter.

He has served on the Board of the Sydney Cove Authority (1994-1998), the Australian Services Roundtable (2002) and the Australian Institute of Steel Construction and was a member of the Sydney Harbour Design Review Panel (1998 – 2008) He has served as a councilor of the National Trust of Australia (NSW) and has been a Board member since 2010. He was chairman of the National Executive Committee of the Cox Group from 1995 to 1997.

He has been Project Director for many of the practice's major projects, both in Australia and internationally. These have received over 30 awards. Important projects include Ayers Rock Tourist Resort, Sydney Football Stadium, Sydney Exhibition Centre and Master Plans for Royal North Shore Hospital, University of Sydney and Macquarie University.

The Sydney Exhibition Centre project architects were Trevor Armitage and Russell Lee, who is a director of COX Architects

The Structural and Civil Engineers were Ove Arup and Partners, who had established a close relationship with the Philip Cox Richardson and Taylor office. In 1986 they jointly bought a central city building in easy walking distance of Darling Harbour, facilitating collaboration at all stages of the design of the project.

The Engineering Project Director was Peter J. Thompson DIC, CEng, MIStructE, MIEAust. He practices as a consultant with particular expertise in structural analysis and design, reinforced and pre-stressed concrete design, structural steelwork design, project management, planning and evaluation. Peter gained a Diploma in Structural Engineering from the Brixton School of Building followed by postgraduate studies in concrete technology at the Imperial College of Science and Technology. He is a Past Fellow of the UK Institution of Structural Engineers and Past Member of the Association of Consulting Engineers, Australia. Peter joined the engineering consulting firm Ove Arup & Partners in 1950, beginning work in the London Office before transferring to Perth in 1968 and to Sydney in 1973. He established a specialization in early phase structural engineering for buildings, having led many ARUP building projects throughout the Australia Pacific region. In 1991 Peter was awarded the Royal Australian Institute of Architects NSW Chapter President's Award for outstanding contribution to the architectural profession and in 1994 he was appointed an Adjunct-Professor at the University of NSW in the Faculty of the Built Environment. Major projects in association with Philip Cox's office include Sydney Football Stadium, Sydney Exhibition Centre & the National Maritime Museum. The Project Engineer was Bob O'Hea.

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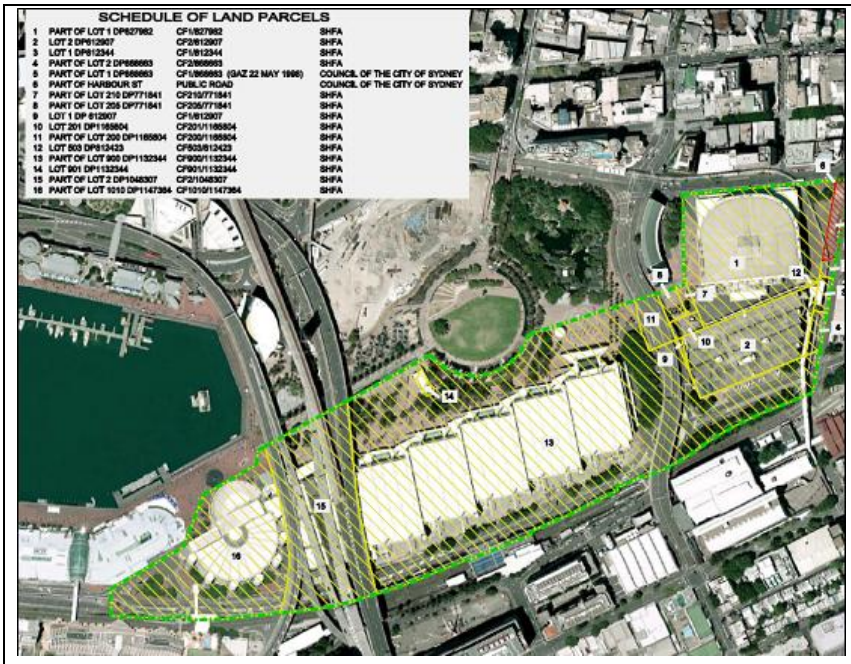
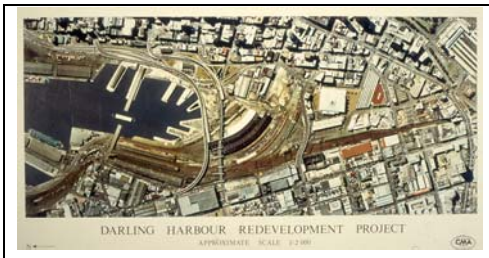
BOUNDARY OF LISTING

Sydney Exhibition Centre is located in Sydney's Darling Harbour. The site is bounded by Pier and Harbour Streets to the south, the Western Distributor to the north, Darling Drive to the west, and adjacent to Tumbalong Park and Cockle Bay on the east. Lot 901 and Part Lot 900 DP1132344.

SITE PLANS:



PHOTOGRAPHS:

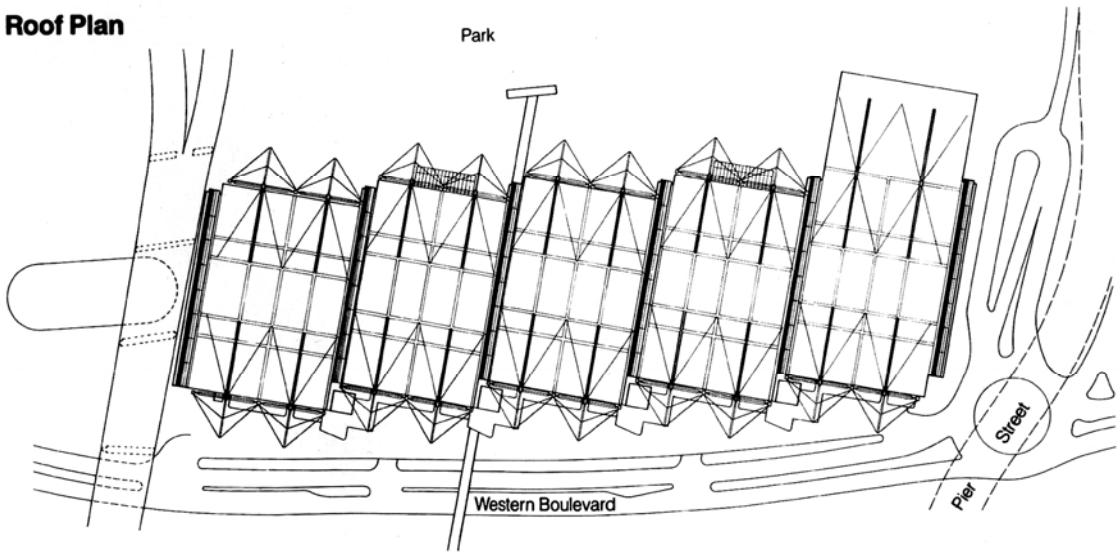





1987

1988





Roof Plan
Park
Western Boulevard
Pier
Street

Appendix 4
Cox Alternative Master Plan Option
March 2012

Darling Harbour Sydney Exhibition, Convention & Entertainment Centre

March 2012

COX

aim...

- an entertainment precinct on the world stage
- continual operations during development & expansion
- three simple stages
- enhance connectivity around and through the Darling Harbour Precinct
- optimise Public Domain
- unified Convention, Exhibition and Entertainment facilities befitting sustainable global cities

‘to create world class exhibitions & conventions on Sydney Harbour’

COX | **DARLING HARBOUR EXHIBITION & CONVENTION CENTRE** MARCH 2012

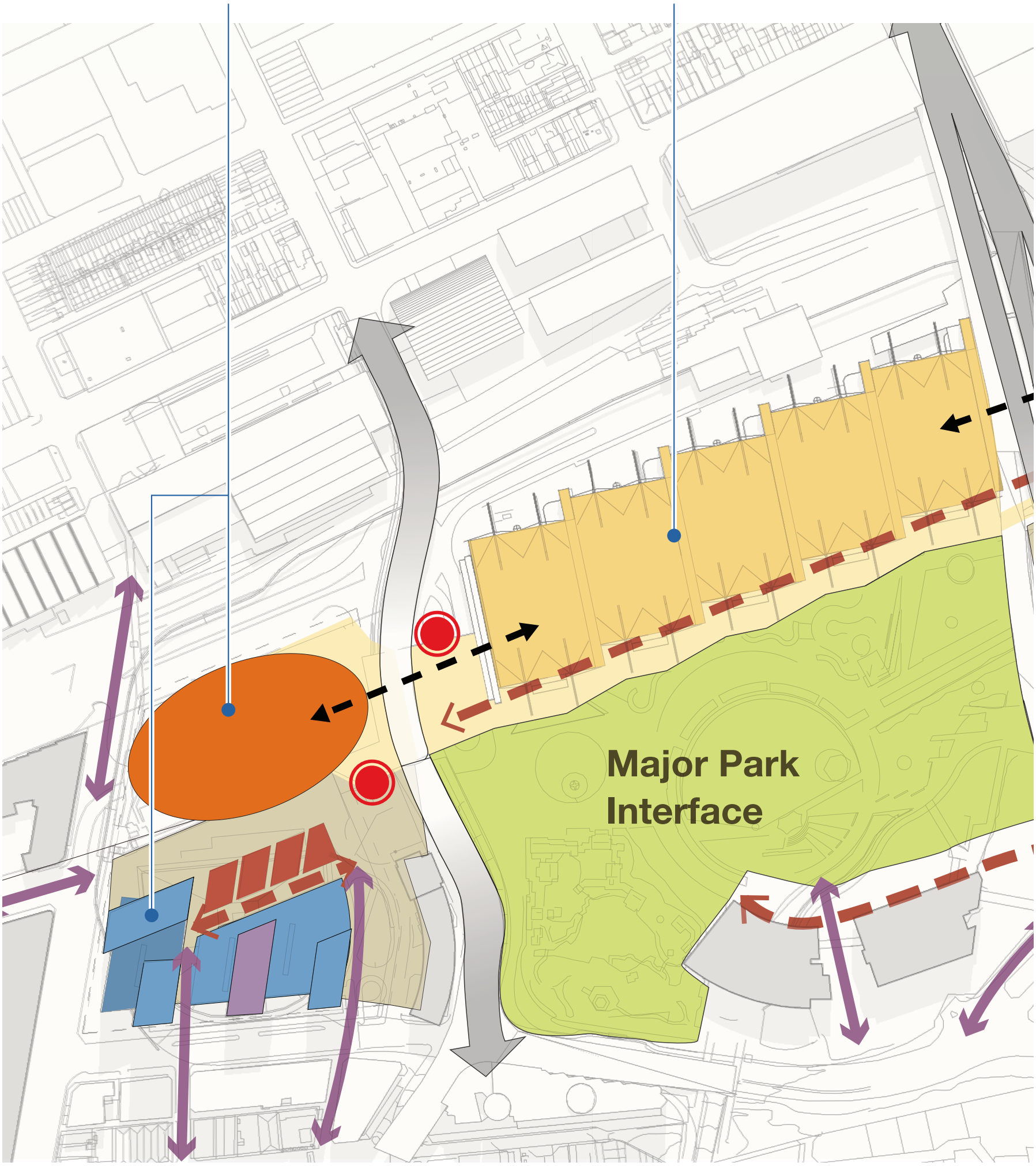
Darling Harbour Structure Plan

Stage 3

New Entertainment/ Public Precinct

Stage 2

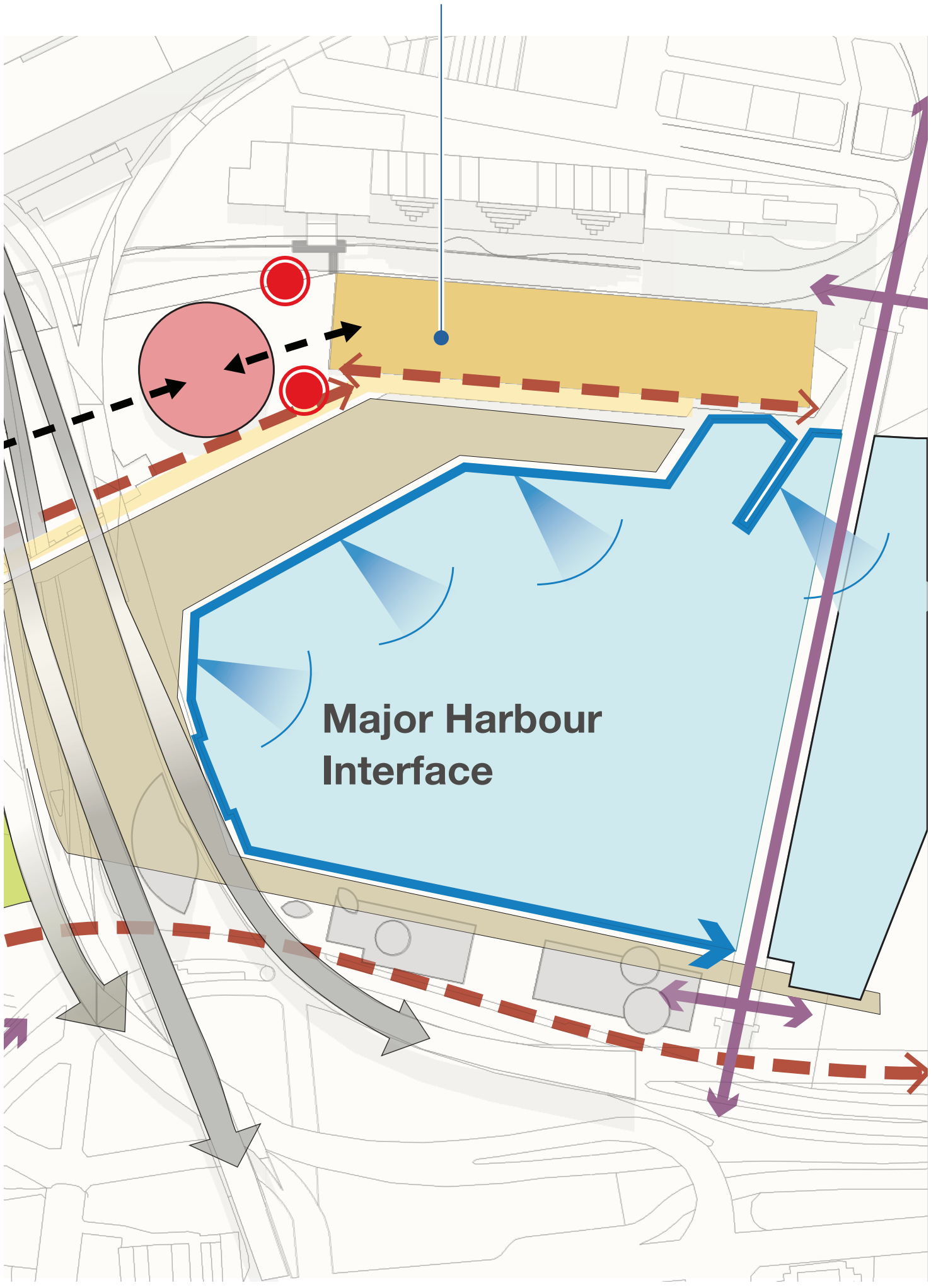
Renew Exhibition



Major Plaza & Transport Access Area

Stage 1

New Harbourside Opportunity



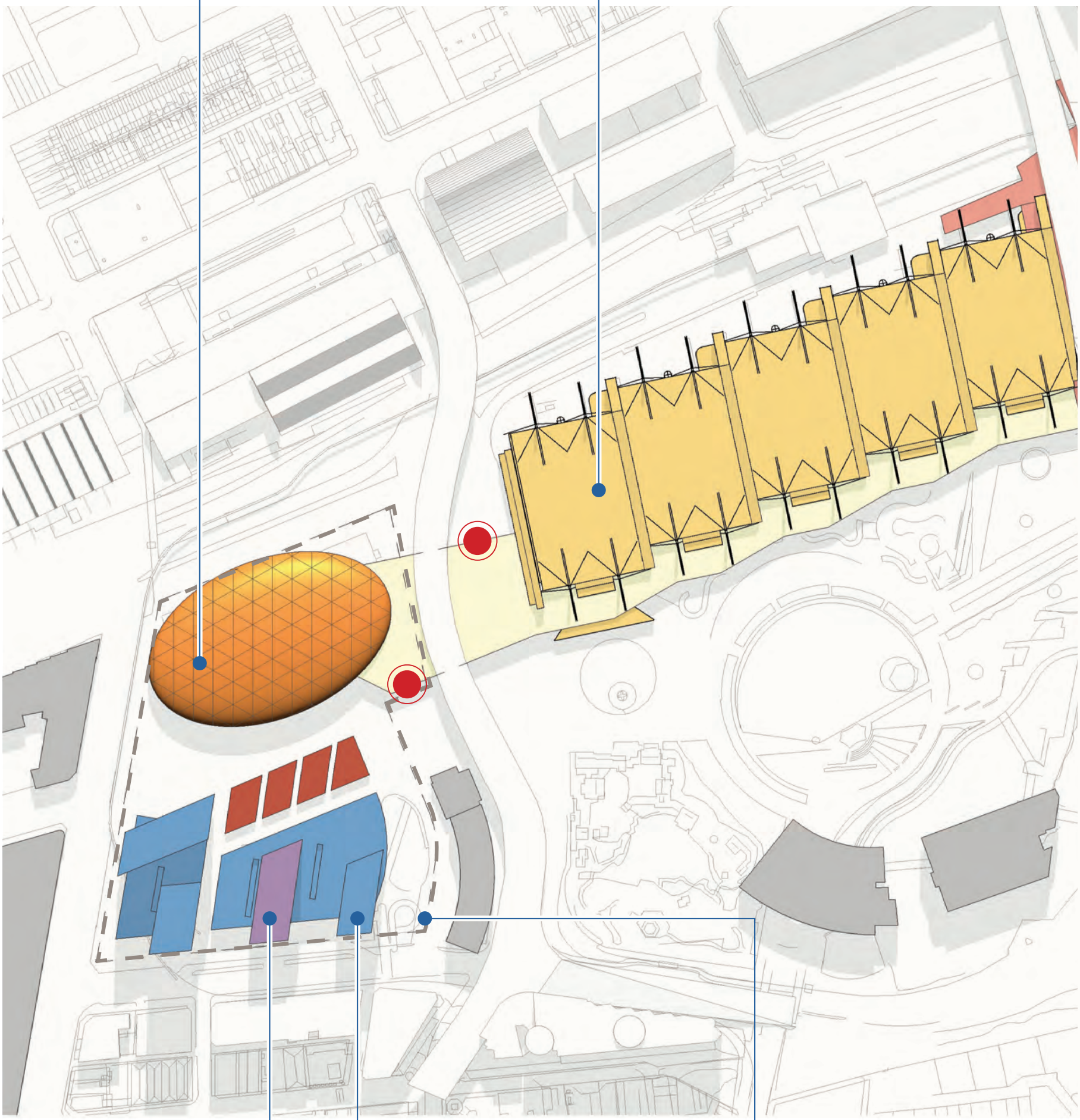
- Commercial
- Hotel
- Retail
- Entertainment Centre
- Exhibition Centre
- Convention Centre
- Plenary
- Existing Buildings
- Public Area
- Major Entries
- Active Water Edge/Veins
- Pedestrian Street Connections
- Egress Between Buildings
- Existing Road Infrastructure
- Active Retail Edge
- Green Space

Strategy 1 | Retain Convention

New Entertainment Centre
Capacity 12,000 pax
(10,000 fixed seats)

Existing Exhibition Hall
Area 25,000m^2

Existing Parking
Bays 900



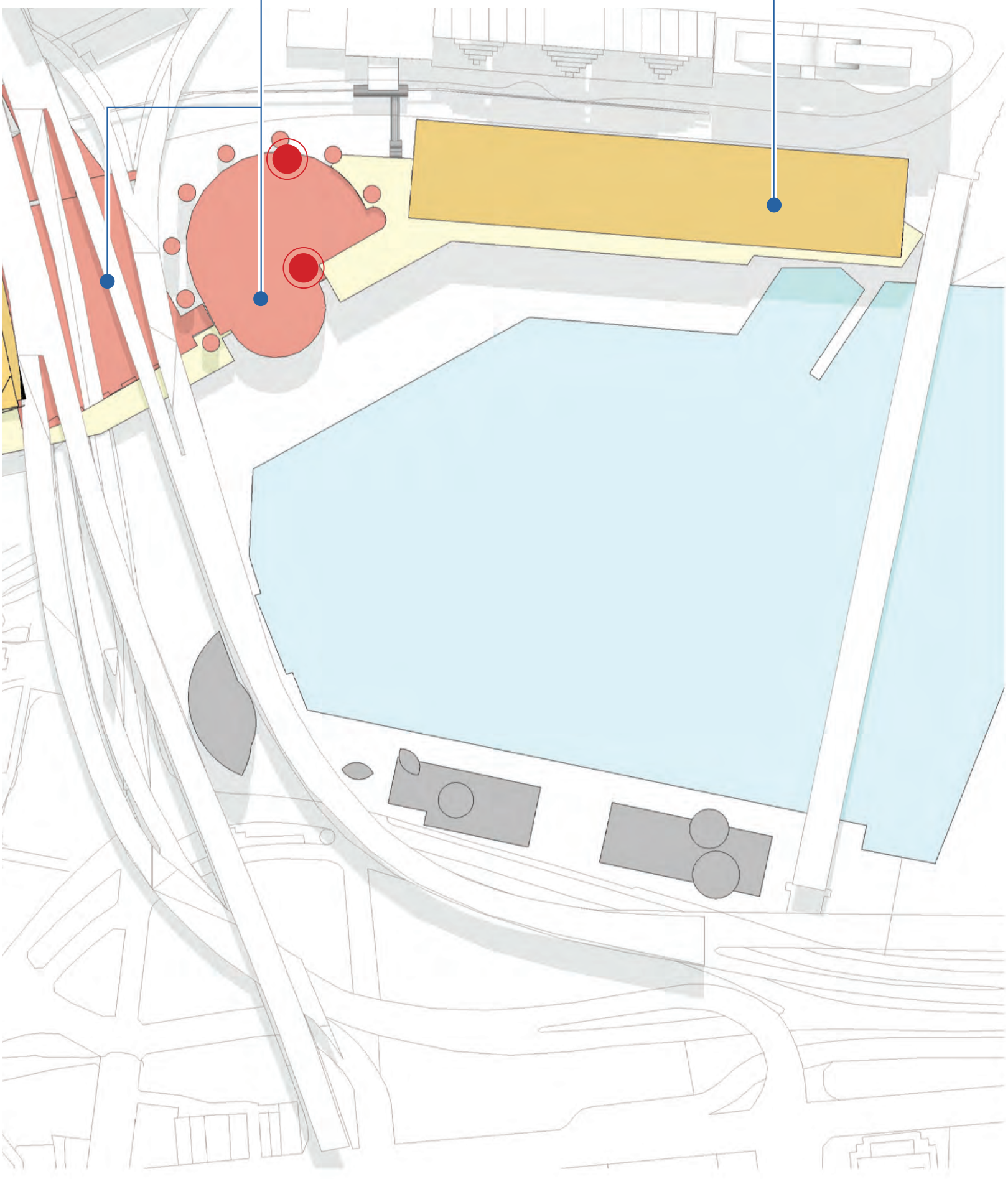
New Hotel
Rooms 300

New Commercial
Development Area 65,000m^2

New Parking
Bays 2,500

Centre

Existing Convention Centre
3,500 pax plenary



Harbourside Opportunity

New Plenary
5,500 pax

New Exhibition Hall
Area 15,000m^2

New Banquet Hall
4,000 pax

New Pre-Function Space
Area 1,500m^2

Meeting Rooms
10,000m^2

Retail/Restaurant
Area 600m^2

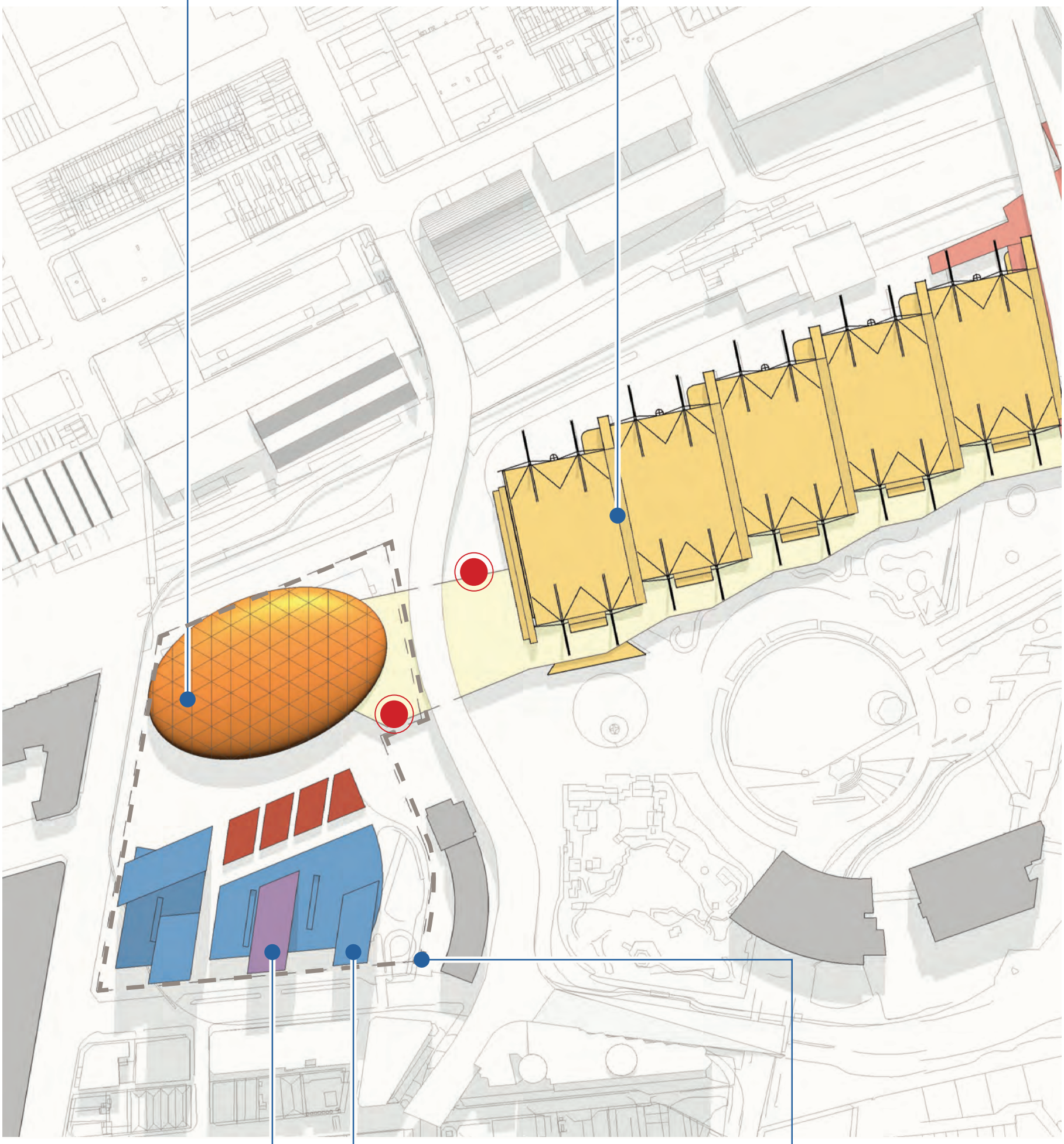
- Entertainment Centre
- Exhibition Centre
- Convention Centre
- Connection
- Commercial
- Hotel
- Retail
- Existing Buildings
- Building Entries

Strategy 2 | New Convention

New Entertainment Centre
Capacity 12,000 pax
(10,000 fixed seats)

Existing Exhibition Hall
Area 25,000m^2

Existing Parking
Bays 900



New Hotel
Rooms 300

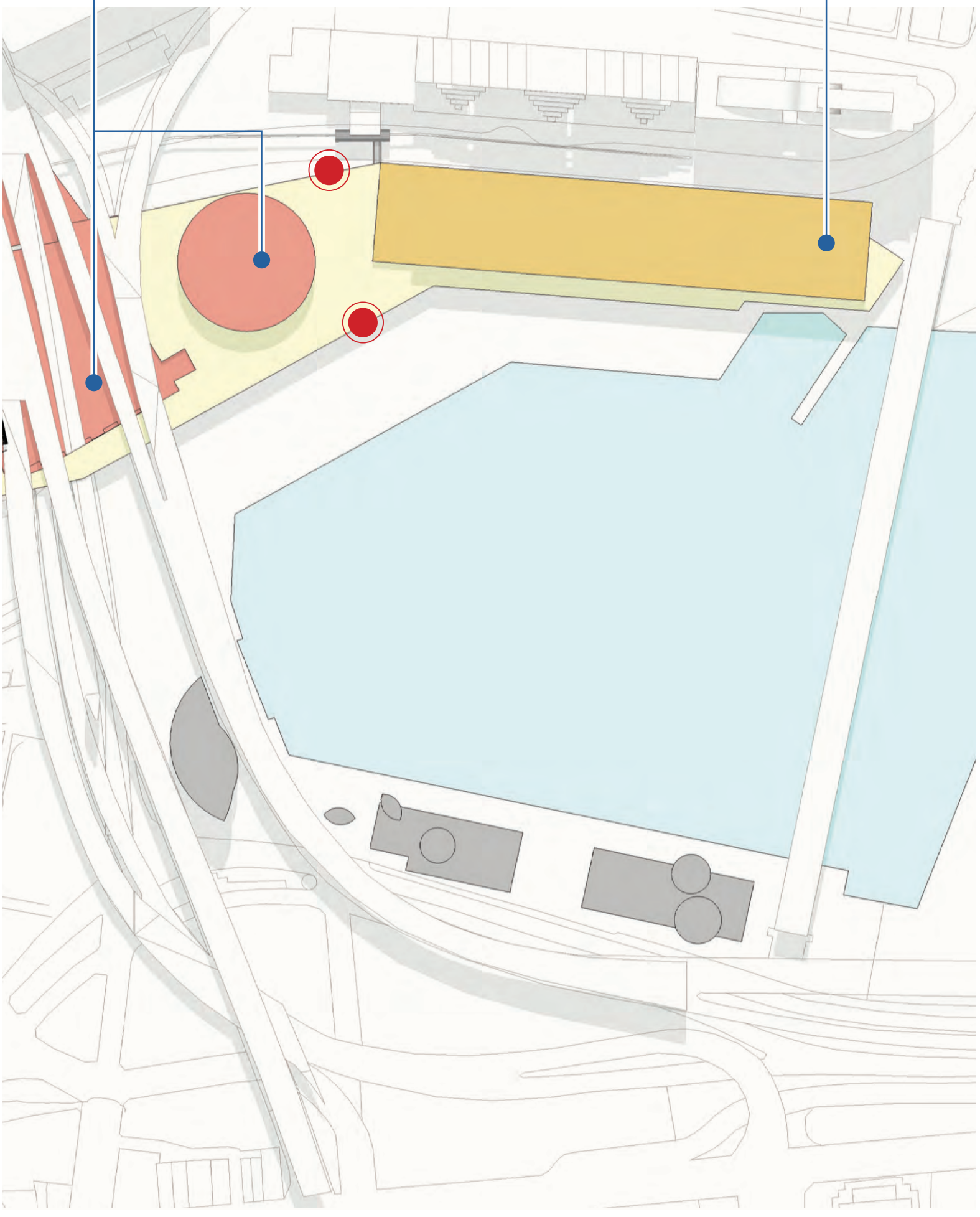
New Commercial
Development Area 65,000m^2

New Parking
Bays 2,500

Centre

New Convention Centre
4,500 pax plenary

New Pre-Function Space
Area 1,500m^2



Harbourside Opportunity

New Plenary Hall
5,500 pax

New Exhibition Hall
Area 15,000m^2

New Banquet Hall
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Retail/Restaurant
Area 600m^2

- Entertainment Centre
- Exhibition Centre
- Convention Centre
- Connection
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- Hotel
- Retail
- Existing Buildings
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Appendix 5 Darling Harbour, Andrew Andersons 2013


Convention Centre

SYDNEY INTERNATIONAL CONVENTION EXHIBITION AND ENTERTAINMENT PRECINCT - DISCUSSION PAPER

CONTENTS

This report has been produced by A. Andersons AO, M.Arch (Yale) LFAIA

INTRODUCTION

It is difficult to find the logic in the NSW Government's proposals to demolish three public buildings, less than thirty years old, designed by three of Australia's best architects and to use their sites for replacement buildings. To do this, temporary buildings will need to be procured. To subsidise the cost of this, over a thousand apartments, a high-rise hotel and thousands of metres of commercial space will be built in a manner that puts pressure on some of Sydney's best parkland and foreshore promenade space.

Development proposals were invited by the Government without any apparent regard to assessment of the cultural, social and architectural significance of these sites. There has been no involvement of the general public to participate in a momentous decision of this kind. No criticism is implied of Lend Lease Corporation which has simply responded to the Government's brief in a competitive bidding process.

Darling Harbour is the NSW Government's finest achievement in the 1980s and 90s and was the focal point of the 1988 Bicentennial Celebrations. The development is hugely popular with the general public, overseas visitors and organisers of convention and exhibition activities. However it has been somewhat reviled by the "design community" and the City of Sydney.

There are a number of reasons for this including the following:

- The unpopularity of Darling Harbour Authority Act of 1984 which gave the Authority and Minister unprecedented powers (This Act was repealed in 1994). The Act streamlined approvals to effect early completion but was strongly criticised by the "planning community" and City of Sydney.
- The unpopularity of the monorail which was approved under the Act despite sizeable public protest rallies.
- The snobbery of Sydney's "opinion leaders" because of the perception of a low-class demographic of many of the

Above
Bob Pentecost briefs NSW Cabinet on Darling Harbour Construction c.1985

visitors (“Westies”) – yet this is the visitor category the Wran Government particularly wanted to attract.

- The perceived lack of “connectivity” of Darling Harbour with the CBD and Pyrmont. This is an aspect of Darling Harbour that could be improved especially towards the South to Quay Street. However these criticisms are largely ideological and representative of conventional solutions which do not bear scrutiny when examining the detailed conditions imposed by level changes, freeways and pedestrian desire lines.
- The desire by the City of Sydney to replace Darling Harbour by a low-rise “urban grid” of housing as illustrated in its “2030 Vision” and to build convention and exhibition facilities over railroad tracks to the south of Central Railway Station.
- Objections to the Darling Harbour scheme by conservation groups for its disregard for the industrial heritage of the site. All the old sheds were demolished however the extensive restoration of Pyrmont Bridge was and item of major expenditure.

For all the above reasons, there have been negative opinions expressed in the past. However, any objective analysis demonstrates that the development is highly utilised and appreciated by the general Sydney public and visitors alike. The pedestrianized public realm with its excellent landscaping, water features and public buildings provides an attractive, refreshing counterpoint to the heavily trafficked street grid of the City of Sydney. The quality of the place has been enhanced by the recently completed “Darling Quarter” development.


ROBERT PLANT
THE VOICE OF LED ZEPPELIN
THURSDAY 28 MARCH
GEALE2

SYDNEY ENTERTAINMENT CENTRE

The Sydney Entertainment Centre was procured by the Wran Government and completed in the early 1980's, prior to the commencement of the Darling Harbour Development. It is a well designed and conveniently located arena structure with a 100 metre clear-span and a maximum seating capability of 12,000.

This facility was located in the city after extensive consultation with promoters of popular entertainments. The Government's original intention was to build the building in Parramatta but the promoters had the strongly held opinion that a suburban location was not financially viable. The building was built under a "turn-key" design and construct contract by John Holland Constructions following an extensive competitive bidding process.

The architect for the building was the late Jack Torzillo of Edwards Madigan Torzillo. Jack was a Sulman Prize winner for the "Boots" factory in Roseville (now demolished). Edwards Madigan Torzillo are best known for the High Court and National Gallery in Canberra.

The building has been the target of criticism which appears to originate with persons associated with the "Superdome" a larger but under performing facility at Sydney Olympic Park, with the view sometimes expressed that Sydney can only support one arena structure of this type.

With its robust structure, excellent sight-lines and generous space standards, the Sydney Entertainment Centre could easily be stylishly refurbished to create an outstanding venue. The work recently carried out at Hamer Hall in Melbourne is an exemplar of what can be achieved. In any refurbishment and redevelopment of the Entertainment Centre carpark site, connection with the Exhibition/ Convention facilities could easily be improved.

SEC at time of opening early 1980s

THE DARLING HARBOUR DEVELOPMENT

Darling Harbour was the site of a major goods yard inter-connecting the NSW rail network with the port of Sydney and the NSW Farm Produce Markets. By the 1970s the containerisation of shipping and the construction of the new Flemmington markets had rendered this facility obsolete.

The Wran Government's original intention was to make the site the location of "Expo 88", a "World Exposition". This was to be a joint venture between the NSW and Commonwealth Governments. However relationships between the two Governments and the Chairman of the Bicentennial Authority, John Reid broke down to the point at which the Wran Government decided to proceed independently with a development to be the centre-piece for 1988. In the early 1980s the Premier's Department called for development proposals from private enterprise. These unfortunately proved desultory. In 1983 the Institute of Architects presented an excellent talk by the late Mort Hoppenfeld, then of the Baltimore Inner Harbour Development Authority describing the highly-acclaimed recent project in Baltimore.

This appeared an appropriate model of what could be done at Darling Harbour and Hoppenfeld was invited to advise the NSW Government. The intentions of his sketch were largely realised and embellished in the ultimate development. MSJ-Keys Young were appointed design managers, designers of public spaces and a selection process led to Philip Cox and John Andrews being appointed as architects for the two major buildings, the Exhibition and Convention Centres, respectively.

Darling Harbour Development Plan

Mort Hoppenfeld's sketch

THE SYDNEY EXHIBITION CENTRE

In the last decades of the 20th century the work of Philip Cox received increasing acclaim for a broad range of buildings. The Sydney Exhibition Centre is unquestionably one of his finest works and together with the refined geometry and landscaping of Tumbalong Park create an outstanding result.

The building has 25,000 sq metre contiguous exhibition space on one level with large scale roof spans and is connected to a continuous lobby overlooking Tumbalong Park to the city skyline. It can be expanded to the South, to the SEC carpark site, by a lobby passing under the Pier Street overpass. If refurbishment is required, this would be far cheaper than providing a totally new building as well as a temporary facility.

This building received the Sulman Award for architecture in 1989. This is a building of unquestionable architectural significance. Had another twenty years elapsed it would be on both State and National Heritage registers.


Convention Centre

THE SYDNEY CONVENTION CENTRE

The Convention Centre was designed by John Andrews, another Australian architect of international repute who came to prominence with his Scarborough College, near Toronto, Canada in the 1960s. One of the outstanding buildings of its decade. After several other major projects in the USA and Canada, Andrews returned to Australia and designed a number of other remarkable buildings in Sydney and Canberra.

The Convention Centre demonstrates the hallmarks of Andrew's style: strong sculptural invention, clearly articulated service elements and a powerful sequence of spaces. The building contains a number of excellent auditoria and meeting spaces. Visitors to the building experience a strong "sense of place" with dramatic views over the harbour towards the city skyline.

The building is particularly successful in its visual relationship with the adjacent massive scale of the elevated freeway. The large sub-divisible auditorium has been used for a wide variety of events including Olympic weight-lifting.

This building could easily be expanded to the north to the Harbourside Shopping Centre site where it could complement a new "Landmark: Convention/Hotel development.


EXIT
ATTENTION


ayside Lounge


ibis HOTEL
Hard Rock Cafe
CYREN
USTRALIAN TRAVEL SPECIALISTS
OPEN
HAPPY HOUR
MON - FRI
3-6 PM
$5
CORONAS
CHAMPAGNE
WINES
10 COCKTAILS
$7
FROM
BAR PLATES
BREAKFAST

OPTIONS FOR CHANGE AND GROWTH

Twenty years ago, Sydney's exhibition facilities were the best in Australia, however subsequently Sydney has fallen behind the offerings of other cities in Australia, and more particularly overseas in this highly competitive market. Darling Harbour is an ideal location for these uses.

It is hard to understand why all three buildings need to be demolished and replaced when they could be added to and refurbished for far less cost than the current total demolition and rebuild proposal which requires costly temporary facilities during the construction period.

If the underperforming and architecturally undistinguished "Harbourside" shopping centre were to be made part of the redevelopment, there would be a broad range of alternative options. In principle, the Exhibition Centre could expand to the south on the site currently occupied by the above.

Cities grow and change and meet to remain imageful and competitive. There is better opportunity for a genuine landmark building, to create an unprecedented new image for Sydney on the Harbourside Shopping Centre site than in the current proposals.


AUSTRALIA
AUSTRALIA DAY

CULTURAL SIGNIFICANCE AND HERITAGE PROTECTION

Unfortunately it is a sorry fact of life that considerable time elapses before buildings are afforded the protection of listing under state or commonwealth heritage legislation. NSW introduced heritage legislation in the late 1970s after the politicisation due to the “Green Bans” and demolition of many fine late 19th and early 20th century buildings.

In the case of Darling Harbour there is cultural, social, historical and architectural significance in abundance – the problem is that all this significance has been generated in the last thirty years. Any methodical assessment would demonstrate that the various venues and the place itself have been the settings of many of Sydney’s major events for the past thirty years and that the principal buildings and parklands are of a high standard and make a major contribution to the image of Sydney.

CONSERVATION AND COLLECTIVE MEMORY

In the 1970s the "Green Ban" movement focused public attention at the irreversible losses being generated by the large scale redevelopment. Since that time Sydney has achieved a balance between conservation of the built and natural environment and the opportunity for economic growth and change.

Few "new world" cities have achieved the retention of so much historic fabric as has Sydney with its 19th century inner suburbs of terrace housing as well as the "Rocks" and "Walsh Bay" precincts. The completeness and character of these areas are an indelible aspect of the ethos of Sydney. So it should be with the principal elements of Darling Harbour. That is not to say that there should not be change – there is much scope for extension and enhancement.

The "Harbourside" shopping centre provides the opportunity for an outstanding extension of convention facilities and a superb site for a luxury hotel. The lessee of Harbourside could be assigned a lease of the ground and mezzanine levels of any new development as compensation. The Entertainment Centre carpark provides significant opportunities to expand the Exhibition Building. The service yard of the SEC could be eliminated to improve connection with the north – south desire line to Quay Street.

In such a scenario what is good about the legacy of the site would be maintained with exciting prospects for what would be new.

COMMENTS ON THE PROPOSED DEVELOPMENT

The twin-tower, high-rise hotel seems to fit most uncomfortably on the tiny triangular site that is the current arrival and taxi rank to the convention centre. The need to cantilever the towers from the base is a demonstration of this difficult relationship.

The faceted planar forms of the Convention Centre have a poor relationship to the freeway compared with the carefully considered geometry of the existing John Andrews building. The building appears to "oversail" Bob Woodward's masterpiece, his recessed, helical fountain. This would have a detrimental effect on this important work of art.

The exhibition building appears split equally over several levels with a consequential lack of efficiency and amenity when compared with the current building (if expanded).
This aspect has already received negative comments from the exhibition industry. Part of the building appears to have a turfed roof, well above street or park level. It is difficult to see how this would adequately compensate for significant loss of public open space at ground level. It is also hard to imagine that this could be considered "defensible space" outside daylight hours. The architectural expression of his building with its small-scaled cantilevered boxes and balconies appears to belie the reality of the building being a large floor-plate universal space. The building has a particularly uncomfortable relationship with the southern edge of the elevated freeway, which it appears to abut. The architectural expression of this building compares poorly with Philip Cox's seamlessly integrated statements in the current, Sulman award winning Exhibition Building.

Tumbalong Park is possibly Australia's finest landscape design of recent decades. Its gently disked lawn enables it use as an informal amphitheatre. Its continuous lawn enables its use for informal games such as "touch – football". Its space is beautifully defined by the annular girdle of spotted gums and beautifully detailed stepped or recessed water feature. All of these qualities will be


EXHIBITION CENTRE
THE EVENTDECK

destroyed in the proposed reconstruction: the amphitheatre is flattened, the integrity of the lawn is destroyed by five diagonal pathways, the spotted gums are chopped down, the water feature is demolished or largely filled in. What was distinctive and beautiful becomes commonplace.

The proposed Arena building with what appear to be 30 metre high clear glazed lobby walls facing east and north seems like model of great operational expense. The expressed functionalism of the current Sydney Entertainment Centre appears fresh and uncontrived in comparison. Negative comments have already been made by the popular entertainment industry about the negative impacts of 30% reduction in capacity when compared with the existing building.


AUSTRALIA DAY
JAN 26

PROCESS

There appears to have been the failure of a proper process to effect a major development that has a multitude of impacts.

In the case of Barangaroo, over ten year period there were:

- public forums as to what might happen
- a two-stage international design competition
- a master plan, based upon the competition and the jury's comments
- a two stage bidding process
- an approval process to revised master plan and project applications.

At all stages there has been the opportunity for public comment.

In the case of Darling Harbour, the Government has chosen to go straight to a private enterprise bidding process, leaving no room for the consideration of real alternative solutions.

This report is not an argument that there should not be change. The city needs to evolve and facilities need to survive competition. The issue is given the vast expense of the proposal and the impact upon items of cultural significance that would be destroyed, there is the need for the Government to review its brief.

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