WORLD ARCHITECTURE

The business magazine for the global architect

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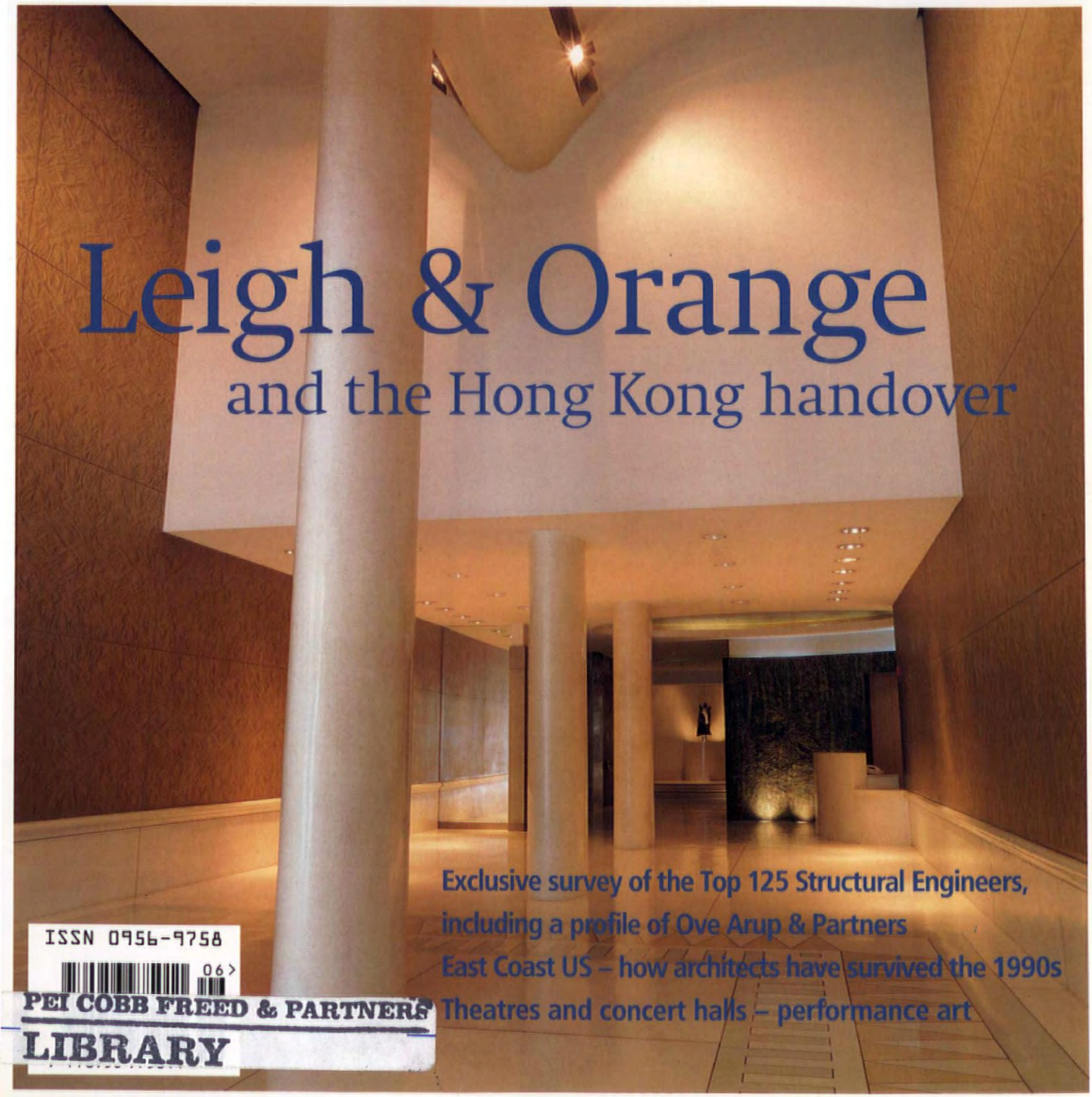

Leigh & Orange
and the Hong Kong handover

Exclusive survey of the Top 125 Structural Engineers, including a profile of Ove Arup & Partners

East Coast US – how architects have survived the 1990s

Theatres and concert halls – performance art

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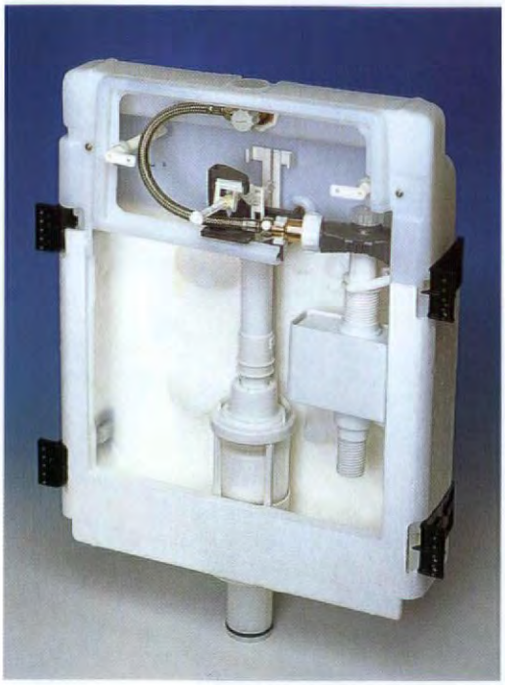
Cover
Detail of the lobby of the Nai Lert Office in Bangkok, Thailand, by Leigh & Orange of Hong Kong.

A selection of Geberit quality products



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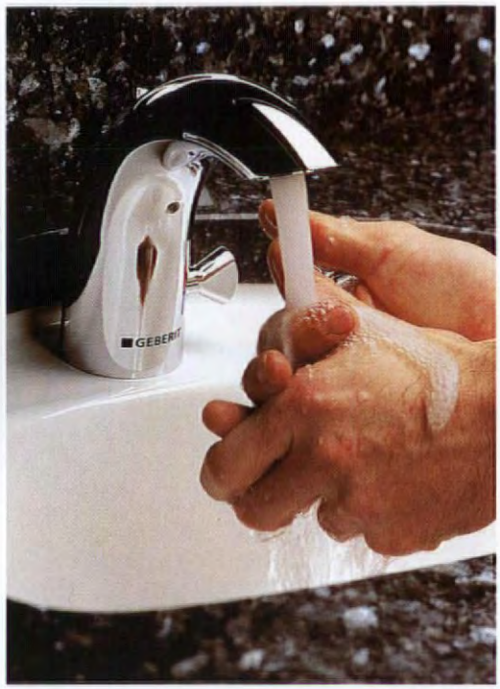

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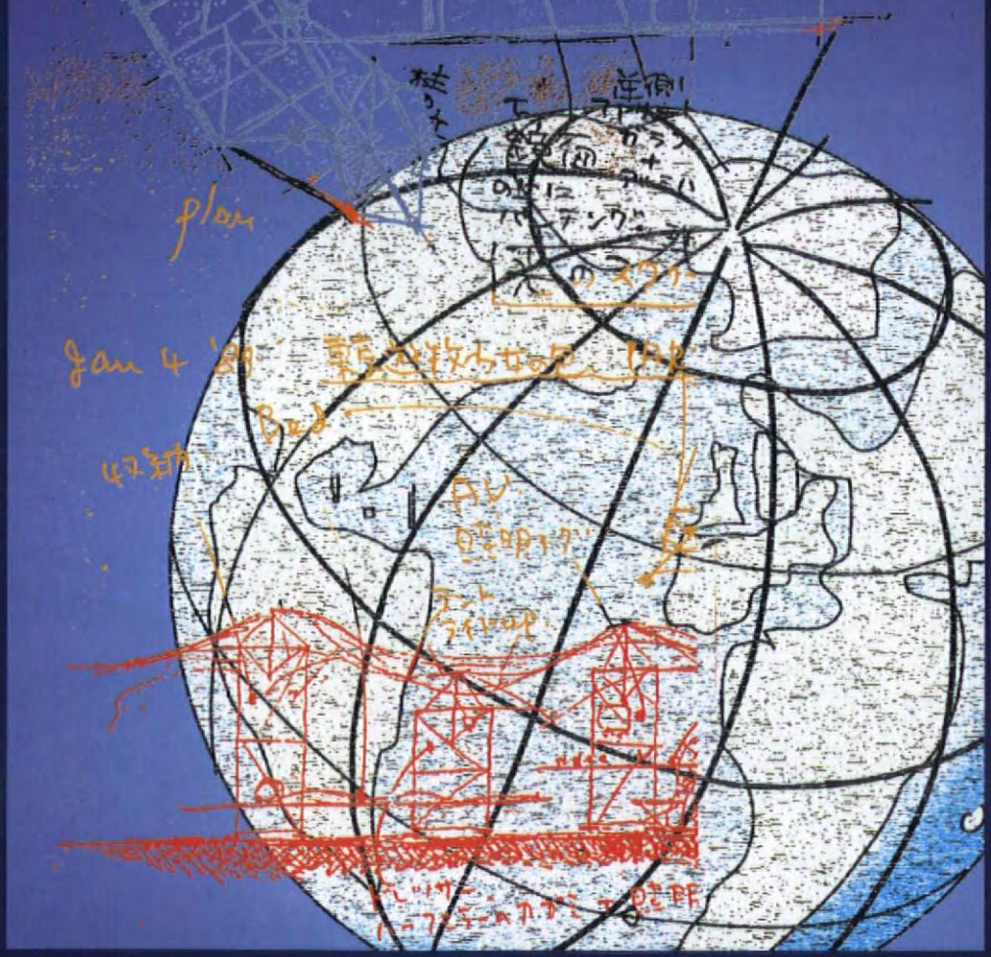

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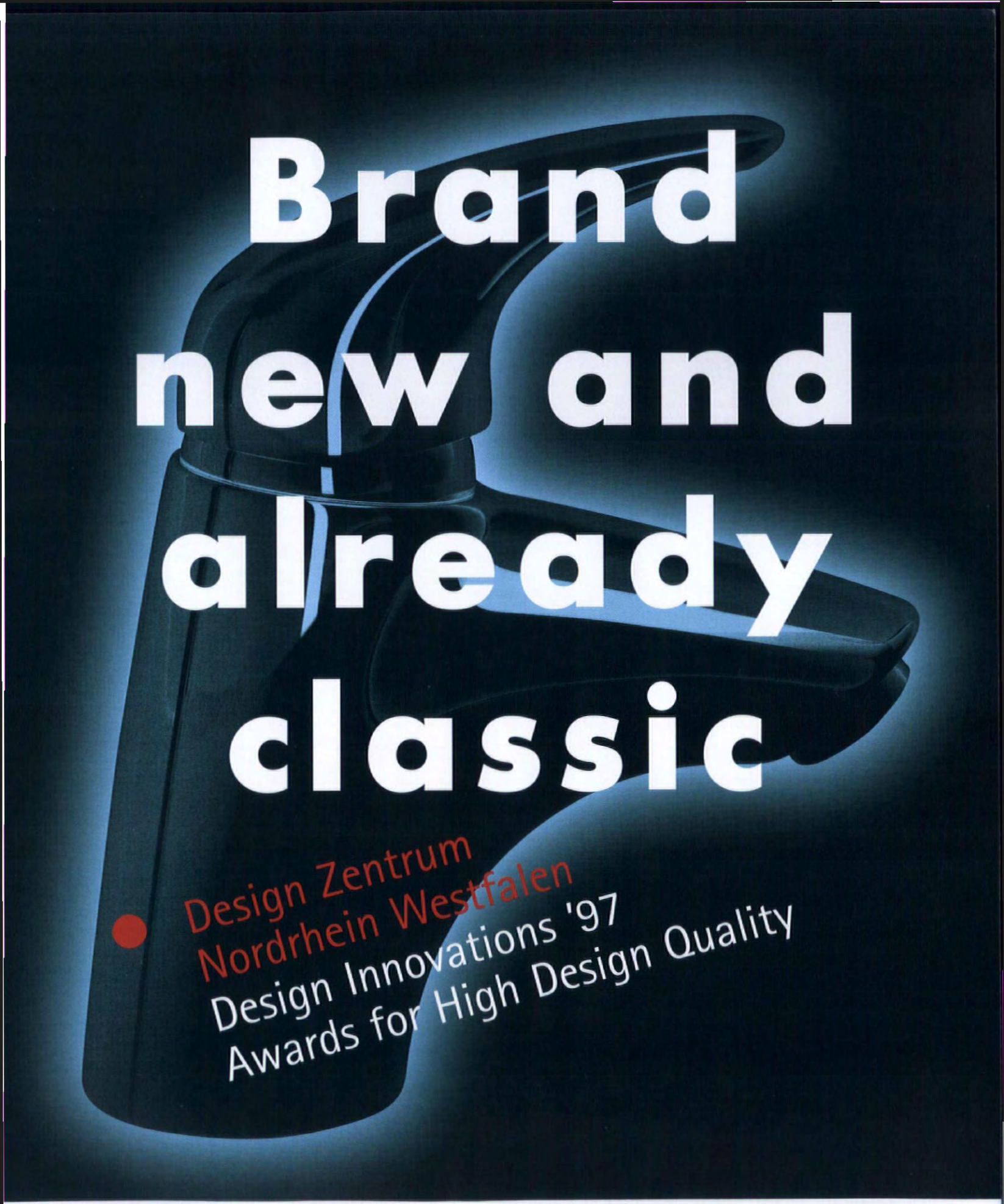

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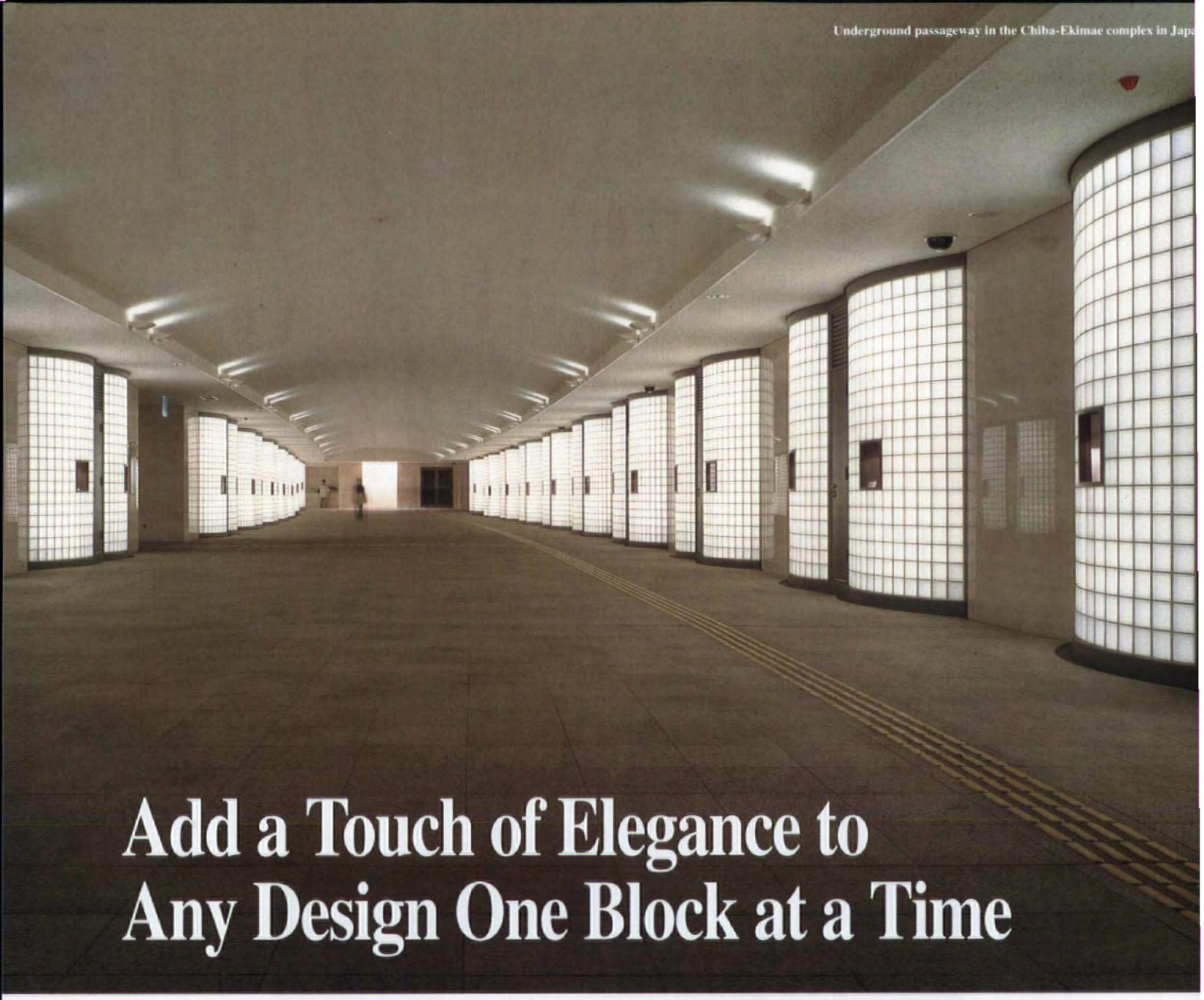

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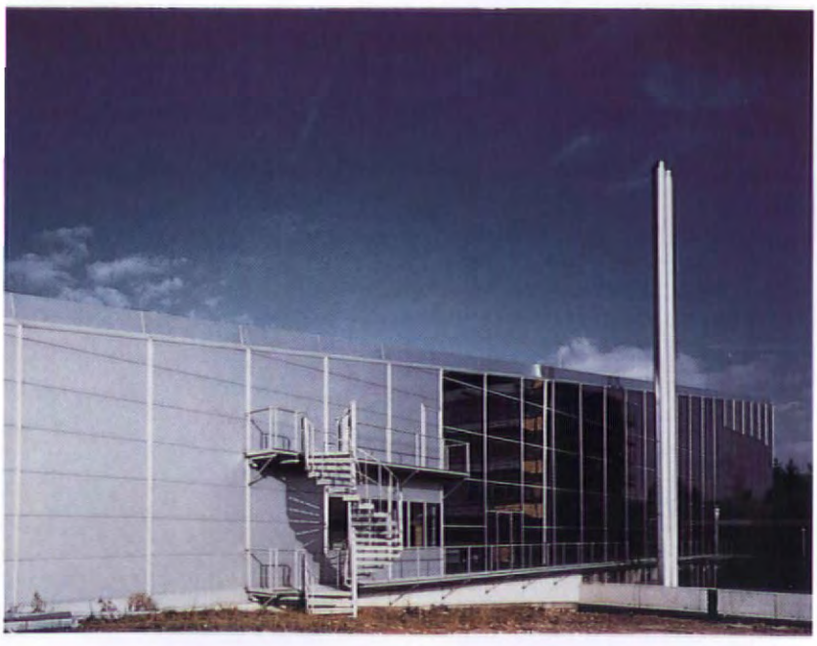

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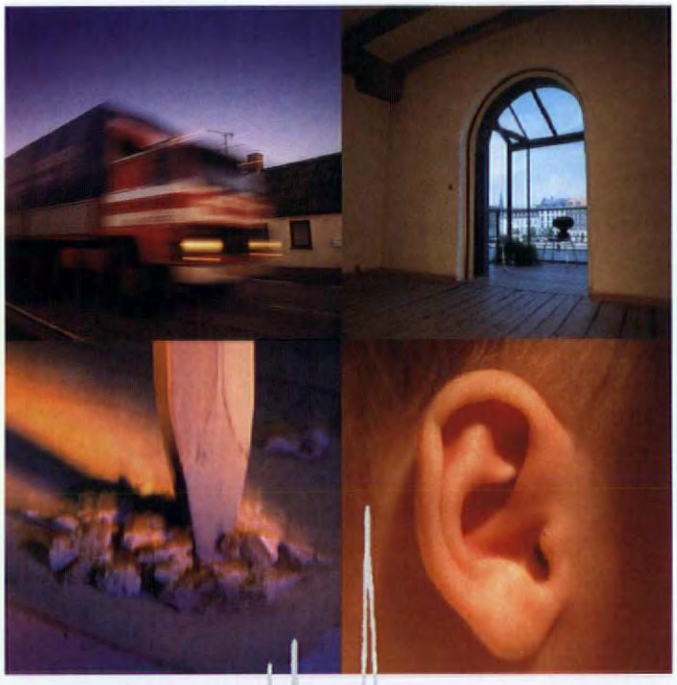

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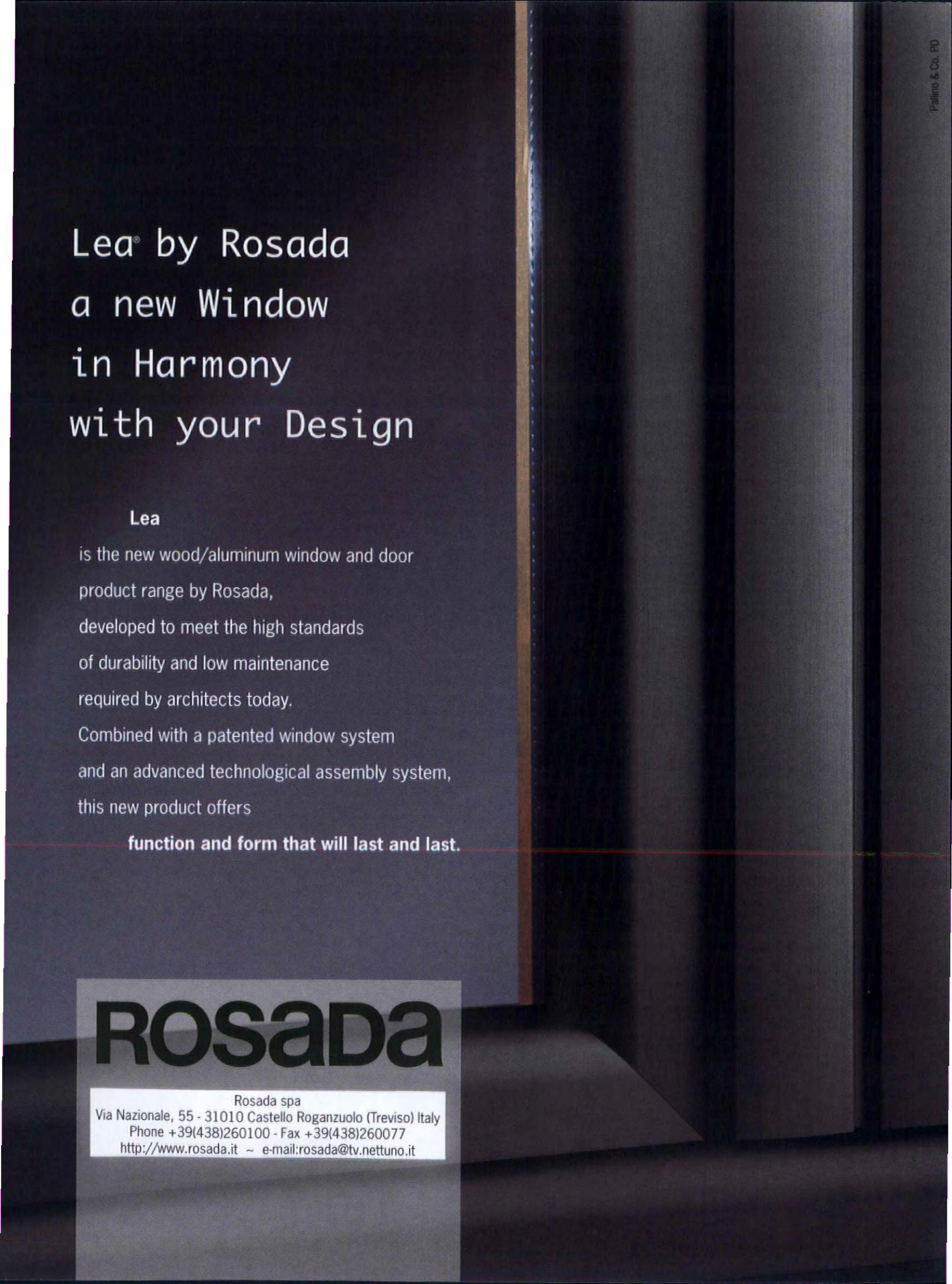

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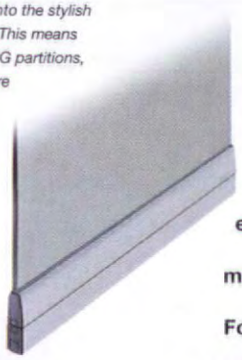

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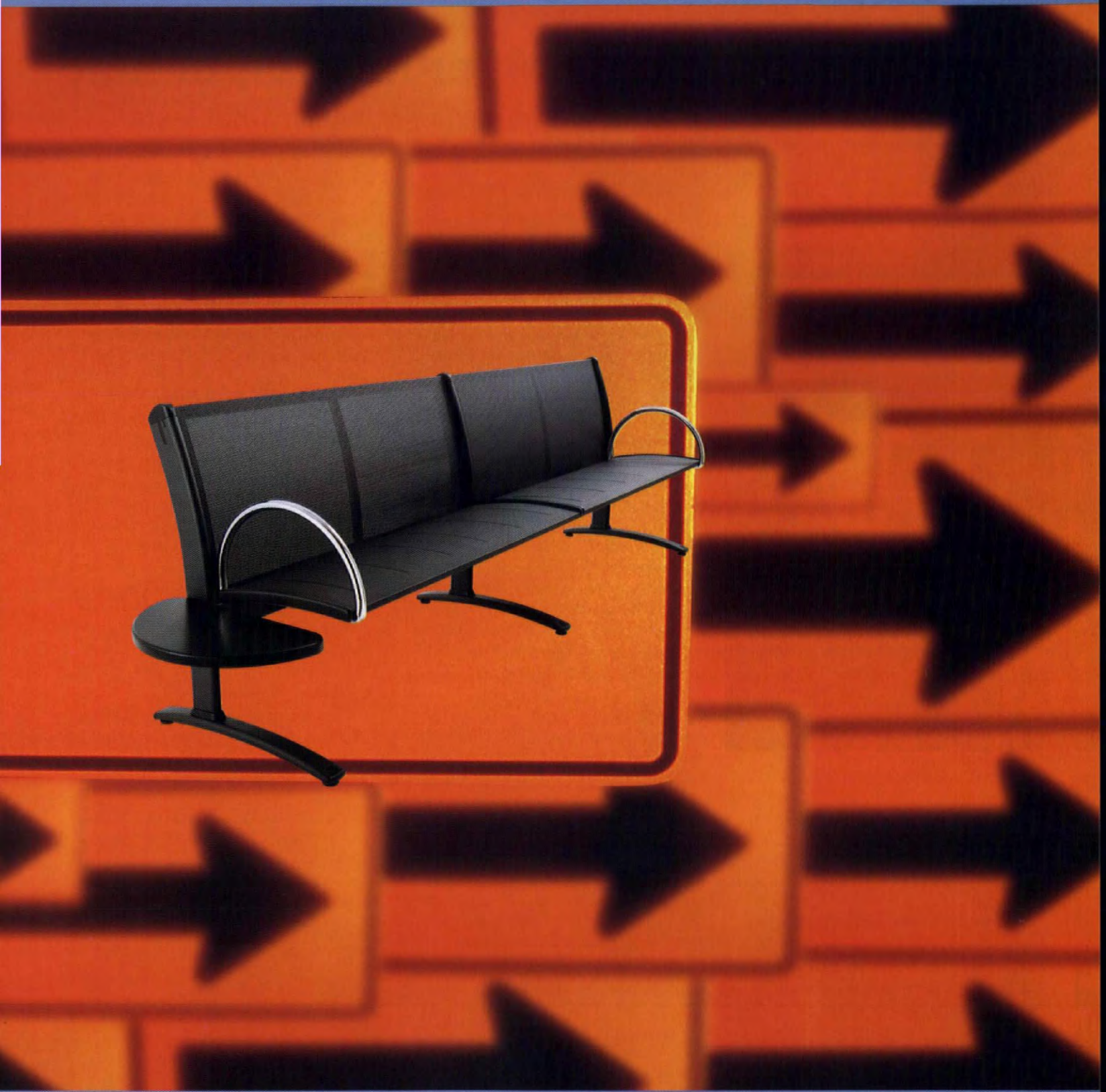

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UNA BELLA COMODITÀ

Renovation of the Haiger Municipal Hall

2250m² of stainless steel strip provides impermeability that lasts

Klaus B. Maier

On the A45 autobahn, south of Siegen, is the exit to Haiger-Burbach. Less than 60 minutes drive from the big cities of the Rhine-Main and Rhine-Ruhr areas, located in the geographical centre of the old Federal Republic of Germany, is the old town of Haiger, which is typical for its framework construction.

The 1,200 year-old town has a colourful history. One of its principal attractions is the Church of Haiger. Built in 1408, the church is notable for the magnificent paintings in its choir hall. Next to the church is a three-storey building, a lovingly restored framework construction. Today it houses the museum of local history (above).

The seventies-style town hall and municipal hall, as well as the activities of the 19,000 inhabitants demonstrate the cultural diversity of Haiger.

The renovation work

The municipal hall of Haiger was inaugurated on 10 January, 1974. The exterior (picture 1) is a strictly delineated construction, broken up by glass windows and faced with natural stone. The building has a flat roof, which is poorly insulated. When exposed to extreme conditions over a number of years – such as the presence of 600 people – the concentrations of vapour produced, as opposed to the periods in-between functions when humidity remains normal, causes the roof to leak. The NIROSTA® Metal Roof System by ESTA* – based in nearby Wilmsdorf – was chosen as the most appropriate solution to the problem given that the existing roof could be conserved and used as the substructure. The only requirement was the removal of the old gravel layer.

Once cleared the roof was ready for the laying of a sloping insulation covering – the slope was achieved by laying insulation slabs of different thicknesses. Walk-on type rock wool insulating slabs were overlaid (picture 2). Contractors, Kentzler made the decision to utilise this slope solution in order to enable swift rain removal via round drains of 100 millimetre in diameter (picture 3). Due to the existing parapet walls, the use of gutters was superfluous (picture 4). The roll seam welding of the stainless steel ensures that the stainless steel roofing system is absolutely water-tight, even on 0-degree roofs.

The handling

Stainless steel strips are usually supplied with a width of 625 millimetres x 0.4 millimetres in thickness, on coils of approximately 200kg. For the Haiger municipal hall renovation 1,200 millimetre wide coils were used (pictures 5/6). The roll-seam welded sheets has to be loaded with gravel, which counteract wind suction loads, thus bypassing the need to use cleats. In order to protect the roof cover from wind-action, prior to the application of the gravel, barrels of water were distributed at premeditated intervals on the roof (picture 7).

On site, the coils were cut to the required sheet lengths and the long seam edges were folded vertically to a depth of 28 millimetres. In the folds, approximately 18 millimetres from the surface, the two sheets were joined using special roll seam welding machines. By the subsequent unilateral folding down of the welded seem through 180° minor welding distortions are compensated and a heavy duty lock seam is created – this procedure does not contribute to the water tightness of the roof cover.

Testing

ESTA-Gesellschaft fur Edelstahlverarbeitung mbH is the owner of the quality seal for the NIROSTA® Metal Roof System. The seal comes with a 10-year guarantee – to a maximum of DM2,000,000. If between the eleventh and thirtieth year, after installation, damage is caused by the corrosion of material, re-installation is provided free of charge. This warranty extends beyond the existence of the original installing company. Membership of the Association of Quality Seal is obligatory for all installation companies, in the interests of the client.

On completion of the renovation work at Haiger Municipal Hall a water-tightness check was carried out by the TUV (Technical Checking Organisation), Nordrheim-Westfalen. This test involved flushing-out the stainless steel roof installation, from below, with helium (pictures 8 - 11). The helium will pass through any unsealed joint due to its low density. For this procedure the TUV have developed a U-shaped plexiglas probe, which fits over the joint. In this instance the tests proved satisfactory, despite the numerous complicated claddings of air shafts, water drains and light domes (pictures 12 and 13).

Conclusion

The highly corrosion-resistant stainless steel, combined with roll seam welding, provides a roof of almost unlimited life expectancy. Even entirely flat roofs can become entirely water-proof using this system. The NIROSTA® metal roof system requires no modification to the existing structure. The existing roof construction, with the exception of the gravel, can be preserved in its entirety, thereby avoiding the problem of waste disposal.

Both ESTA and Kentzler believe that the renovated roof of Haiger Municipal Hall is now water-tight and will survive the ravages of time.

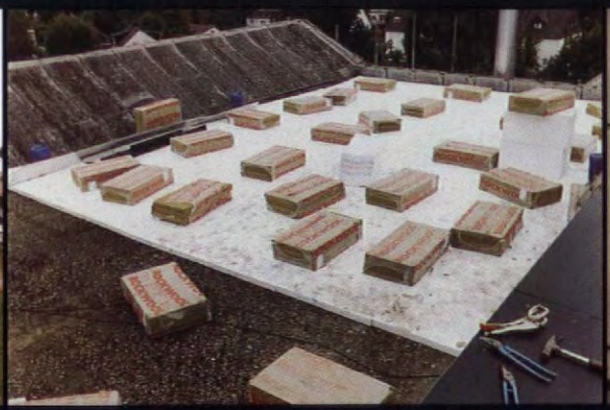
NIROSTA® is a registered trademark of the Krupp-NIROSTA GmbH

ESTA GmbH
Flocksdorfstrasse 4
57234 Wilnsdorf-Anzhausen
Tel: +49 (0) 2737 500 93
Fax: +49 (0) 2737 500 97/500 80

Project data:

Client	The town of Haiger
Constructor	Kentzler, D - 44145,Dortmund, Germany
Roof surface to be redeveloped	2250 square metres
Sub-structure	Single sheet flat roof with heat insulation

1



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Opposite page

Haiger Church, built 1408. The town museum can be seen in the foreground

This page

1 *The Municipal Hall, built 1973*

2 *For the swift drainage of water polystyrene sheets were applied to the faulty flat roof. Walk-on rock-wool insulation sheets were overlaid*

3 *Rainwater is quickly drained by circular drainage pipes, 100 mm in diameter*

4 *The parapet walls limit the roof surface,meaning that gutters cannot be installed. Also shown are the stainless steel strips that replaced the gravel*

5 *Partial view of the municipal hall with hoist*

6 *1200mm wide coils supplied to the site. Pictured in the foreground are folded cleats for the cladding of the parapet walls*

7 *The stainless steel sheets are held down by 50 litre water barrels. A layer of gravel will provide storm protection at a later date*

8 *Preparations for the Nordrheim-Westfalischen test*

9 *The stainless steel roof surface flushed from below with helium*

10 *The TUV test equipment with its sniffing probe*

11 *The true tightness of the folds can be established with the aid of special devices*

12 *Special care was necessary to realise the expert cladding of the elements that penetrated the roof*

13 *Light domes, air shafts and water inlets projecting from the existing roof structure*

13

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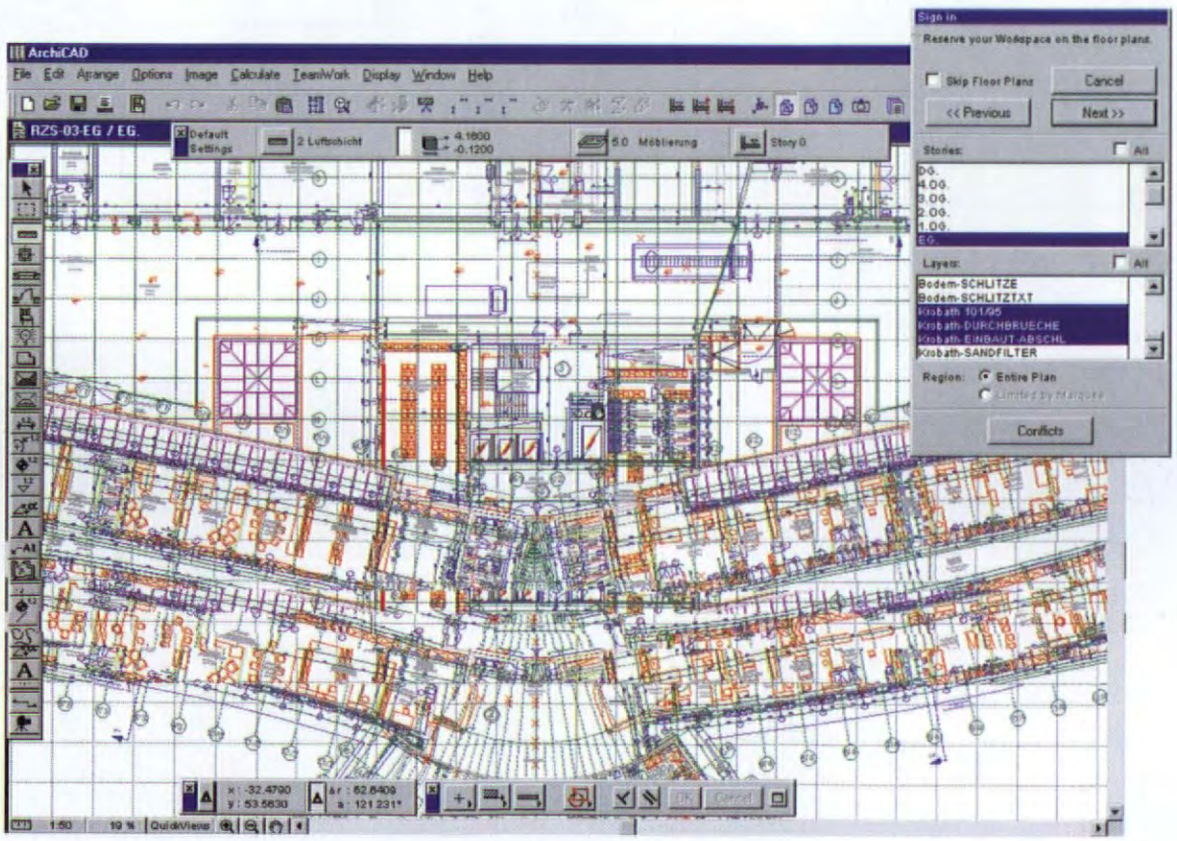

Recreation Center – Bad Schallerbach. Architect: D.I.W. Nussbaumer, Vienna, Austria

Harkins Theatre. Designed and modeled in ArchiCAD, rendered in Artlantis Render.
Architect: CCBC Architects, Inc., Phoenix, Arizona.

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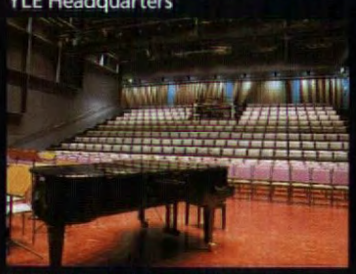

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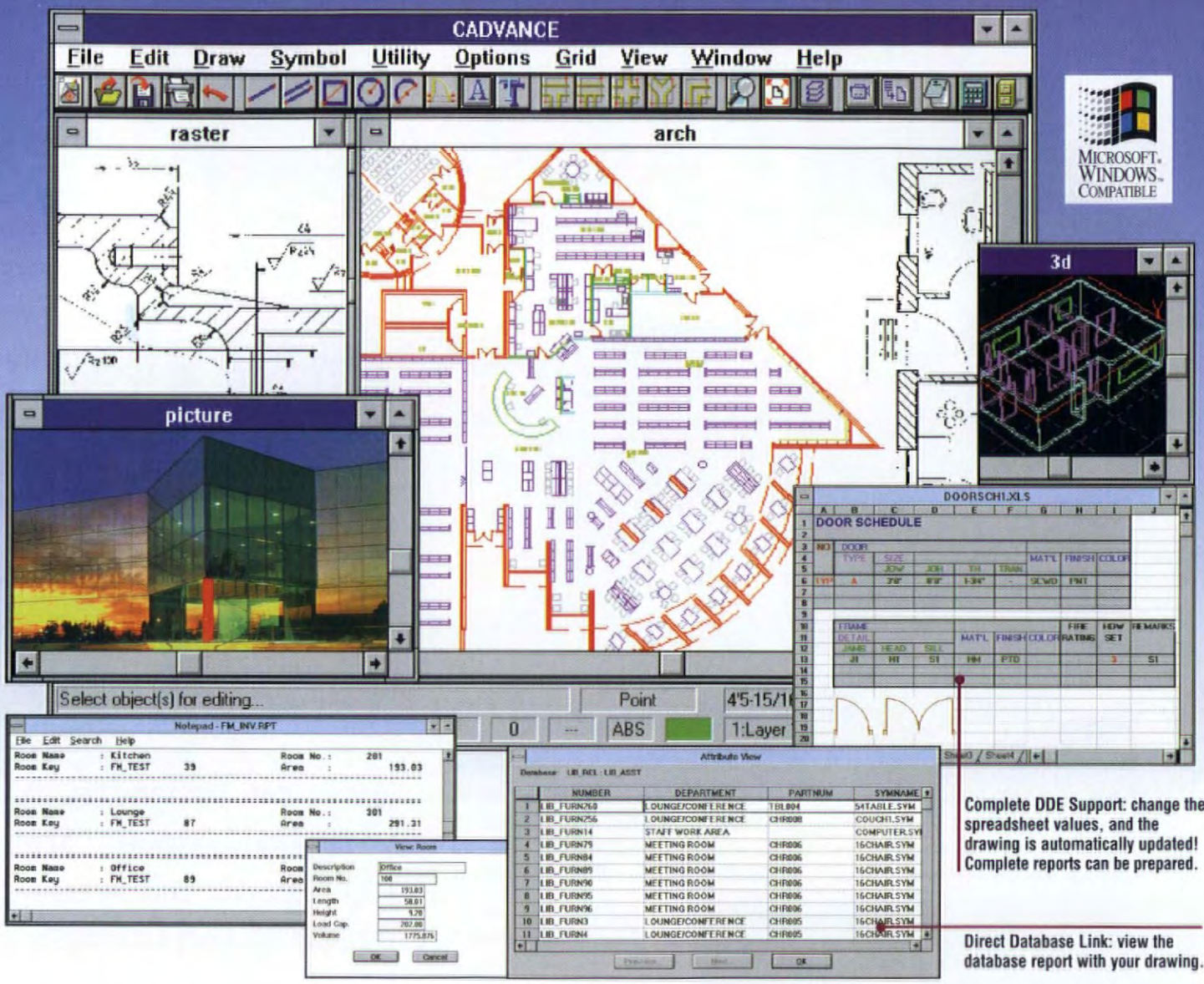

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It's not the size that counts ... or is it?

Sitting in the bar at Mezzo, one of Sir Terence Conran's larger establishments in London's Soho, I was intrigued to overhear a conversation on the neighbouring table between two young Americans, clearly on their first visit to the capital. The subject centred upon the extraordinarily diminutive size of everything in England, from the public buildings, office blocks and houses, to the cars, roads and portions of food. An unsurprising observation given the vast size of their home country, and a clue as to why they had chosen to meet in one of London's mega-restaurants/bars, as opposed to a low-lit, spatially-challenged city pub. But what surprised me was the disparaging tone with which they set about sizing up the country. Is size a sensible yardstick with which to measure the success of a country? Surely not, if the discussion is limited to the physical size of things visible. Presumably yes, if talking about the invisible; the wealth of a nation, the size of its gross national product and the strength of its export industry. Big, in this case, is obviously better. All of which leads me on to this month's unusually large issue of World Architecture.

In the first of a series of surveys relating to other professionals upon whom architects depend World Architecture has published an exclusive league table of the world's Top 125 Structural Engineers. In this case size is most definitely of the essence. The giants in the engineering industry are assessed by the number of structural engineers they employ, and this provides as accurate an indicator as possible to the success and internationalism of each firm. In the case of the UK-based Ove Arup & Partners, the subject of a special 24-page profile within the survey, sheer size is impressively backed up by a record of excellence – both in the diversity of the projects, the quality of the built structures and the professionalism of its staff. For the fourth year running Ove Arup & Partners has been voted the engineering consultancy with which international architects would most like to collaborate. Size isn't everything, but it certainly helps.

A profile of Leigh & Orange, one of Hong Kong's foremost architectural firms, also demonstrates that building up to a healthy size can provide a resistance to the destructive forces of economic and political fortune, surviving and indeed thriving during the worldwide recession of the last decade, and emerging fit and ready for action when the last colony of the British Empire – now, as our American friends would no doubt point out, reduced to the size of a pin prick – is handed over to the great Asian tiger, China, this month.

Nicola Turner

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Letters

"I believe you are well on the way towards being the equivalent of *Time* or *Newsweek* for architects." Ken Yeang, Malaysia

In response to the new design...

From Ken Yeang, Kuala Lumpur, Malaysia
"The new magazine cover looks lovely. I still think it needs just a little more work on the cover design to look more corporate and perhaps a bit more trendy. But I believe you are well on the way there towards being the equivalent of *Time* or *Newsweek* for architects. As a marketing concept it is definitely unbeatable and great positioning..."

From Enrique Lowinger, Panama
"I'm a subscriber of your magazine and I think it is absolutely great. Your country reports are amazing. I loved Israel's! Thanks..."

From D Beglin, Nairobi, Kenya
"Architectural journals have always been regional. *Architects Journal* in the UK, *Architectural Record* in the US, *Domus* in Italy. To see a truly global publication such as yours which gives equal billing to good architecture anywhere, must be the single most important step forward in architectural journals ever. Very well done and congratulations..."

From Maurice Ford, Cottesloe, Western Australia
"Great...I also enjoy the editorials. In April 97 (WA55) you ask 'Who is ... the architect?' We are so in the middle of it, in today's world, what really is architecture?..."

From Kai-Seng Lam, Johor, Malaysia
"Your product section should be more selective, and more easily adaptable for countries of different climate. However, I do like the profile section. How about more introduction of up coming new projects with more exciting illustrations, and a lot more pictures and drawings? Let them do the talking. I can hardly find time to read as I'm too busy at work."

From Thomas KW Tang, Hong Kong
"WA 55 is a definite step forward, but I have a few suggestions for further improvement. Could you include surveys and statistics in a more comparative mode, ie: between countries and regions? Also plans and drawings would benefit from annotation, and the graphic layout of pictures could be organised more in groups..."

Singapore drama

From Vikas M Gore, Director, DP Architects, Singapore
"In your April 1997 issue of World Architecture, you feature some of the upcoming articles in the May 1997 issue of the magazine. Among them, in "Country Focus – Singapore", you mention the "Singapore Arts Centre". This project, now called The Esplanade: Theatres By The Bay, is not a project designed by Michael Wilford, but a joint venture designed by DP Architects Pte Ltd/Michael Wilford and Partners and should be credited as such. From mid-1995 the design of the project has been completely driven from Singapore although from time to time we do keep the London office abreast of developments on the job."

Universal Accessibility Conference, June 12-13 1997

From Rick Lincicome, Ellerbe Becket, Minneapolis, US
"Back in October 1996, when the Department of Justice filed suit against Ellerbe Becket alleging non-compliance with the Americans with Disabilities Act (ADA) the firm called for an industry-wide forum addressing the broader issues raised by the lawsuit. [Reported in WA52].

As a member of the program planning team, I am very happy to let you know that the American Institute of Architects decided to organize just such an event. The Universal Accessibility Conference will take place June 12 and 13 at the Renaissance Washington DC Hotel. Co-sponsors include the Architectural and Transportation Barriers Compliance Board, Associated General Contractors of America, Building Owners & Managers Association International, Paralyzed Veterans of America, United Cerebral Palsy Associations and others.

This important conference demonstrates that architects can positively affect the issue of universal access. Former Senate Majority Leader Robert Dole and Senator Orrin Hatch are both speaking, and participants in the plenary sessions include representatives from the Department of Justice, Paralyzed Veterans of America and disabilities design consultants, as well as facility owners and architects. Ellerbe Becket will be participating in Track 2: Accessibility Requirement of the ADA.

Millennium monuments

From Dr Peter Hancock, Lesotho, South Africa
"The proposal to construct 'two major *world-beating* (my italics) skyscraper projects for the City of London .... the Millennium Tower ... and City Point" [WA54] raises a number of significant urban design questions.

Firstly, the City of London, the proverbial Square Mile, is a mediaeval configuration of narrow streets, radiating from the Royal Exchange and Bank of England, with St Paul's Cathedral as the principal historical monument, spiritual centre and urban design focus.

Secondly, to interpose a 380-metre office tower in the City, more than three times the height of St Paul's Cathedral (111.25 metres to the cross above the dome) appears inappropriate. This would also be almost twice the height of the NatWest tower at about 200 metres. To those who value Mammon more than their Maker this may seem appropriate, when the City of God is totally overshadowed by the NatWest Bank's tower and the Millennium Tower.

Thirdly, a further problem is the navigational hazard to aircraft. Already the Canary Wharf tower, at 250 metres is clearly visible from Heathrow. I have seen it myself from the top of the British Airways Airad Building at Heathrow. The Millennium Tower would be 50 percent higher and two miles nearer to the airport. The real hazard could be to aircraft using the City Airport.

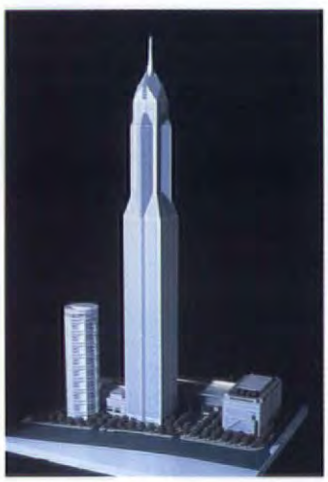
In the context of Sir Henry Wotton's axiom of "commodity, firmness and delight" there are other problems. Martin Pawley, correctly to my mind, decries monumentality in an age of cyberspace [Polemic WA 54] and cites Sir Henry's slogan in support of his contention. It could also be said that "delight" means that architecture should be visually pleasing. This suggests that any building in an urban design context should be appropriate to its environment. This can demand a degree of humility on the part of promoter and designer alike. The bombast evident in the use of a phrase such as "world beating" has more than a suggestion of pride, where humility in the historic context of the City of London might have been more appropriate. Perhaps the last edifice required in the City is another Tower of Babel, overshadowing and dominating St Paul's Cathedral.

Wasn't it the very conceit of the builders of the Tower of Babel which caused the confusion of tongues and the downfall of their cherished illusion to build a tower to heaven?"

WA reserves the right to edit any letter. Please send letters to warch@atlas.co.uk, or fax: +44 171 470 7007. The best letter in *WA* 58 will receive a free Lamy fountain pen.

News Review

Shanghai: building its way to a brighter future



Model of the Daewoo Business Centre, Shanghai

by Adam Mornement

The building boom that has over-run Shanghai in the past few years shows no sign of letting up. The pace of change in a city that only ten years ago was clogged-up with polluting textile factories, and characterised by the fast fading embers of a failing Socialist dream, represents a miraculous metropolitan make-over.

Foreign investment lies at the heart of Shanghai's dynamic drive for a new identity. Foreign joint ventures with local businesses, added to the multitude of available labour – the city government recently estimated Shanghai's population at 17 million, one million up on last year thanks largely to an influx of migrants from neighbouring provinces – have contributed to the city's "spirit of the new".

As with any would-be international city, Shanghai is aiming to position itself as a financial centre to rival any other – Tokyo, New York, London, Hong Kong. In fact, given the hand-over of Hong Kong to Chinese sovereignty at the end of the month, much has been made of Shanghai's intention of wresting the mantle of "Asia's first international centre" from the island province. The reality is rather different: Shanghai's re-birth is being underwritten, on a large scale, by Hong Kong's property developers, and any loss of confidence on their part would have potentially catastrophic consequences for Shanghai's ambitions. Nevertheless, thanks to long-term commitment and financial support from both local and central governments on behalf of Shanghai's rebirth, building work and the development of a new financial zone on the eastern side of the city carries on regardless.

Perhaps the most dramatic of recent architectural commissions in the city is a 92-storey, 420-metre high office and hotel tower, designed by John Portman & Associates (JP & A) which, when complete (2001) will be the fifth highest building in the world. The tower comprises one of four elements making up the 370,000-square-metre Shanghai Daewoo Business Centre. The complex also includes a nine-storey department store, a 37-storey luxury apartment tower and a retail and entertainment galleria. The development can be seen as typical of the many projects of its type in Shanghai in the sense that it has been funded by a foreign firm, and it is intended to symbolise the new corporate pulling-power of Shanghai. As a spokesman from JP & A explained: "Daewoo wanted a project to dramatically affirm their commitment to invest in China".

JP & A are only one of many western firms currently working in Shanghai. Chicago-based Lohan Associates' 1,250,000-square-foot office and hotel complex, Jin Hui Plaza will go on site later this year – the firm are already working on their Shen City Plaza and Changfa projects in the city (as reported in WA54).

Fears that the building boom might lead to an over-supply of office space have been upheld with recently released statistics revealing that vacancy levels stand at 50 percent more than they were three years ago. But even this has done nothing to dampen the spirits of local government who have made tax concessions to local and international firms in order to keep rents down and, more importantly, keep appearances up.

Sisters doing it for themselves

As if the invasion of the once cosy and comfortably insular world of museums by hi-tech, multi-media wizardry wasn't enough, the men in tweed jackets and corduroy slacks now have a new threat – women. Joan M Soranno of Minneapolis-based Hammel Green and Abrahamson Inc recently unveiled her winning design for the Women of the West Museum, in Boulder, Colorado. Soranno was originally chosen from a short-list of six architects in May 1995. The evolution of detailed design studies was a lengthy procedure involving the development of a "virtual" tour through the museum using video and state-of-the-art visual software.

With an impressive list of honorary trustees, including former First Ladies Barbara Bush, Nancy Reagan, Rosalynn Carter and Betty Ford, the 100,000-square-foot museum will seek to "trace and interpret the history of women of all cultures who helped shape the American West".

The structure is deeply embedded in the landscape; the galleries and exhibition areas open out onto a walkway with dramatic views of the Flatirons and Rocky Mountains. The low-rise, circular form of the main building blends functional modernity with environmental sensitivity.

The interactive identity of the museum is extended to extra-curricula activities: it is hoped that after-hours educational events will involve the local community in the day-to-day life of the pioneering museum. A 6,000-square-foot dedicated educational facility will provide resources for teachers and pupils of all ages.

An estimated date for completion has not yet been publicised.

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1: Photomontage of the Women of the West Museum designed by Joan M Soranno of Minneapolis-based Hammel Green and Abrahamson Inc

2: Model shot of the museum

News desk: Adam Mornement. Please send press releases through by fax: +44 171 470 7007; email: warch@atlas.co.uk or call +44 171 470 7020

In brief

BAHRAIN

Banking on Bahrain

Abbey Hanson Rowe Architects & Planners, the British practice awarded the contract to design and build the new National Bank of Bahrain headquarters in Manama in February, has already begun work on site. When complete the US$30 million (£18.75 million), 25-storey tower, which cantilevers from its concrete core leaving a column-free external wall affording full-height glazing, will be the tallest building on the Persian Gulf island state. Abbey Hanson Rowe is working in association with contractors Jalal Costain WLL.

BRAZIL

Just for show

Construction has commenced for the Aeroclube Plaza Show, a 28,000-square-metre entertainment and retail festival centre in Salvador, Brazil. The design concept and theming was developed by ID8, the imaging and entertainment division of RTKL Associates Inc. The developer of the project is Nacional Iguatemi Inprendimentos SA of Rio de Janiero and the architect-of-record is Salvador-based Andre' Sa' e Francisco Mota Arquitetos. Located in the State of Bahia on the site of an old private air strip, facing the Atlantic Ocean and Salvador Beach, the development is scheduled for completion early next year, to coincide with the start of Carnival, Brazil's festival of masquerade and celebration.

ITALY

Bofill's Bolognian blow-out

Ricardo Bofill's proposals for the demolition and re-development of Bologna's historic railway station have been shelved, in the wake of a public referendum indicating a massive ground swell of discontent. Plans to replace the station with a contemporary equivalent, topped by two skyscrapers received support from only 35 percent of the 130,000 citizens of Bologna who expressed an opinion. Changes to the existing station are necessary to accommodate a new high-speed train link to north Italian city. It now seems probable that the project will be open to an international competition.

SOUTH KOREA

Multi-million dollar broadcast facility in Ilsan

The master plan for the Munhwa Broadcasting Corporation's (MBC) new 1.9 million-square-foot facility in Ilsan, South Korea has been completed by US firms, the Austin Company and RTKL. Ilsan is a new satellite city north of Seoul. Costing US$480 million, the focal point of the development is a 450,000-square-foot headquarter building for MBC. The site also comprises a 1.4 million-square-foot multi-media broadcast facility and a 150,000 square-foot visitors centre and museum – the public element of the development. K R Jagannath, director of Asian projects at the Austin Company has stated that, due to the enormity of the project, development will take place over two phases. "Phase one, including the broadcast centre is slated to be fully operational in December 2001."

UK

Millennium Tower falls short

In recognition of the strong probability that Sir Norman Foster's controversially-proportioned proposal for the Millennium Tower, London was likely to have been refused planning permission, developers Kværner have asked Foster to design a new building for the site. The original 385-metre-high-tower, which would have been the tallest structure in Europe, provoked consternation when the plans were announced late last year. Kværner's decision to approach Foster takes into account the feelings of, amongst others, English Heritage, the Royal Fine Art Commission and the London Planning Advisory Authority. Details have yet to be released on the size and form of the modified tower.

USA

Viñoly develops artistic complex

Rafael Viñoly has been selected as architect for the new US$203 million Regional Arts Center in Philadelphia from a group of finalists that included Barton Myers Associates Inc, Pei Cobb Freed & Partners and Cesar Pelli & Associates.

The Center is a new arts complex to be located on the Avenue of the Arts at the junction of Broad and Spruce Streets. The new building will house an adaptable hall, with seating for between 700 and 1,200, and a new 2,500-seat concert hall that will serve to augment the existing performing arts facilities provided by the Academy of Music.

Amongst Viñoly's most recently completed projects is the critically acclaimed Tokyo International Forum.

Tadao Ando wins in Fort Worth

Tadao Ando has been chosen to design the Modern Art Museum of Fort Worth's new building. Ando beat off competition from Richard Gluckman, Arata Isozaki, Carlos Jiminez, Ricardo Legoretta and David Schwarz in wining the contract with the Texas-based institution. The Museum's expansion will be accommodated on a 10.96-acre site adjacent to the Kimbell art museum, Fort Worth. Acquisition of the site was made possible by a grant from the Burnett Foundation of Fort Worth. The Museum's new building is Ando's first major commission in the US.

St Paul's new Science Museum

The ground breaking ceremony for the Ellerbe Becket-designed Science Museum in St Paul, Minnesota was held on 29 April. The new-build US$75 million project, scheduled to open on New Year's Eve 2000, is located on St Paul's river front. Its riverside frontage has a fragmented, layered appearance, while its street facade side conforms to existing urban forms. Visitors will enter the building on the fifth level and follow a glass-enclosed stairwell down the bluff toward the river where scientifict exhibits will be on show. The Museum aims to make education a major part of its focus: added to its 1.5 million exhibits will be an IMAX/Omni theatre. Completion is expected in 1999.

High class lower school

Boston-based Earl R Flansburgh + Associates has completed design of the new Lower School located on the campus of the Maimonides School in Brookline, Boston. Currently on site, the 35,000-square-foot facility will accommodate 320 kindergarten and first, second and third grade pupils of the Orthodox Jewish day school. The US$4.4 million project is scheduled for completion in September. Bowdoin Co of Needham, Massachusetts is general contractor for the project.

ERRATA

The translator of Takeshi Nishizawa's report on street furniture, in the article "The word on the street" (WA56) was Mika Jones.

"The Hillier Group comes down the mountain", included within *In brief* WA56 stated incorrectly that Saipan, an island in the West Pacific is part of the Philippines. It is not part of the Philippines, though it is sometimes referred to as part of the Northern Mariana Islands. The hotel referred to in the article will be built on Saipan's Mount Tapochau.

People and practice

UK

Buro Happold

Buro Happold has announced the promotion of six engineers, working in the company's Bath, Leeds and London offices, to associate status. The recipients of the honour are: Simon Wainwright, Martin Kealy, Nigel Horns, Robert Okpala, Matthew Lovell and Angus Palmer. The moves are the result of a period of sustained international growth for the multi-disciplinary consulting engineering consultancy.

Wren-Rutherford and Austin-Smith: Lord link up

Austin-Smith: Lord Architects has joined forces with award-winning architects George Wren and Roan Rutherford to establish a joint company, Wren-Rutherford, who will be headquartered in Ayr, Scotland.

The Royal Incorporation of Architects in Scotland (RIAS) appointed George Wren as their new president in early May.

Richard Ellis

Richard Ellis international property consultants has been operating as an incorporated company since 1 May. The incorporation has resulted in the merging of the various existing Richard Ellis operating groups into a single operating company, Richard Ellis Group Limited.

USA

Hillier Group

Dr George C Skarmeas AIA AICP ASID IIDA has joined the Hillier Group as Director of Historic Preservation. With over 20 years experience in the field, Dr Skarmeas will be responsible for maintaining the Hillier Group's restoration division and setting the design guidelines for the future reuse of historic properties throughout the country.

FRCH Design Worldwide

FRCH Design Worldwide has announced the appointment of David Wales as Senior Vice President and Creative Director. Wales, previously with Interbrand Schecter, where he served as Vice President and Creative Director for Retail Design, will oversee all of the creative work in FRCH's New York office.

HLW

Ms Mavis Wiggins and Ms Carolyn Brooks have been appointed as Senior Associates in HLW International's Interior Architecture Group, New York. Ms Wiggins moves to the company from her position as designer/design associate at Kohn Pedersen Fox. Ms Brooks was previously Studio Design Director at Butler Rogers Baskett.

Philanthropic Centre in Riyadh

The ground-breaking ceremony for the Sir Norman Foster-designed Al Faisaliah Centre, in the centre of Riyadh, for the King Faisal Foundation was held on 25 March. The foundation stone was unveiled by Riyadh's Governor HRH Prince Salman bin Abdul Aziz al-Saud. When complete the 260-metre, 30-storey office tower, the focal point of the Centre, will be the tallest building in Saudi Arabia. The Centre will also feature a 224-room, five-star hotel, 100 luxury apartments, a multi-purpose banqueting and convention hall and a three-level shopping centre. Proceeds from the Al Faisaliah Centre will help fund the King Faisal Foundation's numerous philanthropic projects world-wide – the Foundation is noted for its support of academic and ecclesiastical groups. Construction will last for 36 months.

Rogers court in the act

The Richard Rogers Partnership (RRP) have evolved an innovative solution to a complicated new complex of law courts on an awkward 25,000-square-metre site in the centre of Bordeaux, France. The RRP, whose competition-winning scheme was submitted in 1993, expect construction of the US$43.2 million (FF250.5 million) scheme to be complete next year.

Framed by a neo-classical law court building and traversed by a section of the original medieval walls, complete with bastions and moat, the new scheme is integrated into the urban fabric by means of a new public piazza.

The main courtroom building is set on a heavy stone podium, from which a giant skeleton frame with a continuous glazed facade rises, defining the western edge of the site. When complete, all but one of the seven clearly identifiable individual courtrooms will be enclosed within the frame. The seven volumes are tapering in section and rounded in plan. Supported on pilotis, the entire entrance level will function as an uninterrupted public concourse.

The courtrooms were originally conceived as exposed ferro-cement structures. The design team has since explored the potential of stressed-skin systems that offer greater flexibility of construction and greater durability, including a lightweight aluminium honeycomb sheet structure – a technique usually employed in the aircraft industry – with a painted epoxy resin finish.

The RRP have worked with general contractor, Spie Citra Midi Atlantique, and structural engineers OTH Sud-Ouest and Ove Arup & Partners International Limited on the development. The contractor for the court timber structures is Cosylva.

Mr Katsuhisa Kida

Love of Labour

The British construction industry has voiced widespread approval of the Labour Party's landslide victory in the national election, held on 1 May. As reported last month, Labour were the only one of the three main parties to offer any realistically supportive manifesto pledges to the buoyant industry, and true to their word the party sought to add credibility to their promises by putting forward three key bills in the first session of the new Parliament – opened in May by the Queen. The three bills call for: a referendum on a new council and mayor for London; the provision of social housing through the liberation of local authorities capital receipts – a move that would free upwards of US$800 million (£500 million per annum) – and the setting up of at least nine regional development agencies in an attempt to foster genuine and long-term links between the Government and the construction industry.

One potential area of controversy surrounds the party's handling of the Private Finance Initiative (PFI). Industry leaders are aware that Labour are likely to make amendments to the existing system once the current wave of projects has gone ahead. However, opinion differs as to what changes should be made. Sir Martin Laing, chairman of Laing and chairman of the Construction Industry Employers Council feels that the principles of the PFI should remain in place, whilst Sir Frank Lampl, chairman of Bovis has called for measures to speed up and simplify the PFI thereby reducing the costs of bidding and procurement. The Government's biggest hurdle is their plan to axe all future PFI prisons – the National Audit Office published a report in early May praising the performance of the institutions. Whilst Labour have expressed their support for public-private partnerships with regard to the up-keep of prisons they will have to establish a firm PFI policy if they are to avoid confusion over public expenditure in other key areas, namely in the fields of health and education. The Labour party have inherited one of the strongest economies in Europe; results are expected.

On a less political note; the Royal Institute of Chartered Surveyors (RICS) April report on the state of the British construction industry forecast that 75,000 jobs are expected to be created in the construction industry over the next three years, and the market will grow faster than the rest of the economy, with costs rising at more than twice the rate of inflation. This is due, in part to the continuation of Lottery funding: a flood of Lottery-funded projects delayed by the election campaign have been unleashed as funding mechanisms return to normality. These include a US$91 million (£57 million) grant made available to 48 public parks around the country; a US$9.44 million (£5.9 million) contribution to a Renton Howard Wood Levin (RHWL)-designed theatre refurbishment in Birmingham and an award of US$112 (£70 million) to the Sports Council for numerous projects under their control.

A bridge to the future

Tsing Ma Bridge, the main traffic artery to Hong Kong's new international airport was opened by former British Prime Minister Baroness Thatcher in late April – Mr Tung Chee-hwa the future leader of Hong Kong, though invited, was conspicuous by his absence. With a central span of 1,377 metres the Tsing Ma is the longest single-span suspension bridge in the world to carry both road and rail traffic. It was engineered by an Anglo-Japanese consortium lead by Kværner, in association with Mitsui and Costain. Typhoons, the logistical complexity of lifting the 1,000-tonne deck sections 70 metres into the air from the sea and the difficulties inherent in handling the two main 1.1-metre-diameter cables were just some of the problems encountered in the construction process. The US$900 million bridge is a significant step towards the completion of the islands' US$20 billion airport programme.

Piano towers over Sydney

Renzo Piano has designed a new US$640 million (A$500 million) commercial and residential complex for a site at 155 Macquarie Street, previously known as the State Office Bank, in Sydney. Set to become the first Piano-designed buildings in Australia, the developers, Lend Lease, are hoping that Sydney's Central Business District's new "landmark" structures will be complete in time for the Sydney Olympics in 2000.

The complex consists of a 34-storey, 50,000-square-metre office tower, and 16-storey residential building, both of which Piano has designed to have "a strong dialogue with the Royal Botanical Gardens it faces, and the not far-off Opera House". Although, in essence, the two towers are rectangular, they will be wrapped in curved skins of non-reflective glass creating an overall, sculptural form.

The high-rise, city centre project marks something of a departure for Piano whose output over the years – including the Pompidou Centre, France, Kansai International Airport, Japan and Bari soccer stadium, Italy – have been characterised by technological innovation, rather than towering scale. However, Piano hopes that the Lend Lease towers will "tell a fresh, new story", a story which Piano intends to dedicate to the environment, historical context and social life.

The unveiling of Piano's proposals mark the end of a long-running dispute between Lend Lease and local architects about the new owners plans to demolish a notable Ken Woolley modernist structure on the site.

New landmark for San Jose

Holt Hinshaw Architects' new San Jose Repertory Theatre, San Jose is nearing completion. The structure, on site since December 1995, has in turns been described as: a "great blue beast", an "industrial apparatus" and a "gleaming lantern" by local onlookers.

The stand-alone project is a 527-seat, two-level house and working home for the Repertory Theatre. Located in the heart of San Jose, the US$15 million building's metallic blue corrugated steel exterior panelling ensures a constantly changing interplay of light and shadow in the bright, Mediterranean climate of San Jose. It's angular form plays the dual role of ensuring that no two views of the building are the same, whilst helping to impose the theatre in a tight, regimented urban context.

No one in the audience will be further than 58 feet from the edge of the stage. Audience expansion onto the removable stage front apron space, and into the balcony-level "flex" zones on either side of the proscenium will expand the seating to over 600.

The theatre will be completed in November.

See this month's Special Report for a comprehensive overview of international developments in theatres and concert halls.

WATG design new hotel in Aqaba

Wimberly Allison Tong & Goo Architects are working with London-based urban design and landscape firm, the Derek Lovejoy Partnership, on a new hotel in the south Jordanian resort of Aqaba. The Aqaba Movenpick Hotel will be located adjacent to the archaeological site of the Islamic city of Ayla (1988), over two plots of land. One plot, housing private apartments, is located on the beach overlooking the Gulf of Aqaba, the other looks over Corniche Street. The most striking feature of the development is the bridge, with integrated swimming pool, linking the main complex with the apartments and beach club. Construction starts in 1998, with phased completion over two/three years.

Zanadu's pleasure dome in Taiwan

Pre-construction work began in May on Project Zanadu, a US$200 million indoor ski development in Taiwan – the "X" in Xanadu being replaced by a "Z" for reasons of superstition. Taiwanese client, Switzerland of the East Limited, have commissioned British-based architects, Renton Howard Wood Levin (RHWL) to design the 130,000-square-metre "real snow theme park", which is to be built near Kaohsiung in southern Taiwan.

The futuristic building will have one of the world's largest clear span roofs, measuring 140 metres by 180 metres. The 20,000-square-metre upper floor will house ski areas, snow boarding and tobogganing facilities as well as an "Alpine Village", all in a controlled environment in a country with a tropical climate. Other amenities to be built on site include an aqua park, virtual reality entertainment centre, hotel, multi-screen cinema and a restaurant positioned in a capsule standing on twin 90-metre high towers. The snow will be provided by means of the "Winter Wonderland" technique, a system devised by Acer Snowmec Consultants Limited of Birmingham, UK. Construction management on the 39-month project will be carried-out by a 20-strong team from Bovis International Construction Civil Engineering and Consultancy's Taiwanese subsidiary, Bovis Schal Incorporated. Construction itself will take approximately 30 months , with completion due in June 2000.

News Analysis

On-going initiative to revitalise Germany's Ruhr-area

by Ingerid Helsing Almaas in Germany

The IBA Emscher Park is entering its eighth year. In contrast to the last IBA (Internationale Bau-Ausstellung) in Berlin in 1987, the giant environmental revitalisation project now being carried out in the Ruhr is not primarily about buildings. The area along the river Ruhr in north-western Germany, which was dominated by heavy industry for more than a century, has been left with enormous ecological and social problems as a result of a recent industrial decline. Faced with a legacy of contaminated land a redundant workforce, the federal land of the North Rhine-Westphalia announced its plans for the IBA in May 1988 (work began a year later). Rather than being a traditional assembly of building objects, this exhibition operates as the co-ordinator for a ten-year project which brings together local authorities, national and European funding and professional expertise in over 100 projects spread over an area of 800 square kilometres along the river Emscher, from Duisburg in the west to Bergkamen in the east.

The projects undertaken, ranging from re-naturalisation of watercourses to building research centres, are intended to establish an overall development structure which will aid local and regional authorities in years to come. The IBA receives no separate funds. All its projects make use of existing private and public funding structures through existing regional, national and inter-European subsidy programmes. The 30 full-time IBA staff work with local authority departments on, for example, housing or forestry, they co-ordinate applications for European Community funding and they work with private developers and outside consultants. As a result the local authorities have been given the opportunity to focus their otherwise disparate efforts in one effective direction.

The projects of the IBA Emscher Park fall into five main categories, all with different time scales and objectives:

1) *The Emscher Landscape Park*

The need for conscious management of local green areas was recognised already in the 1920s. The "Emscher Landscape Park" is a concerted long-term effort to connect the parks and green public spaces of 17 towns along the Emscher, a total of 300 square kilometres, into one green corridor through the region, laid out for recreational use.

2) *Ecological regeneration of the Emscher river*

Due to the risk of subsidence around the still existing network of mine shafts, the Ruhr district has not been able to construct an underground sewage system, and the Emscher and the streams feeding it are mainly concrete lined open sewers. As only 13 pits of the 150 operating in the 1950s are still being worked, these open channels are now being replaced by underground pipes, local treatment plants are being constructed and the concrete embankments are removed to encourage rainwater seepage onto the streams. The project is expected to take 20-30 years to complete.

3) *Working in the park*

With local unemployment rates significantly above the national average and traditional industries still in decline, the region is trying to concentrate on service industries and the new sciences to attract investment. New buildings of high architectural quality act as visible signs of this, and the 22 new building projects include the Science Park in Gelsenkirchen by Kiessler + Partner, the ERIN commercial park in Castrop-Rauxel and the Innenhafen commercial park in Duisburg.

4) *Housing and urban development*

To convince the local population not to desert the region, 26 new "garden city" housing developments are in the planning phase or under construction, providing 3,000 new flats of which 75 percent are public sector rented accommodation.

5) *New uses for industrial buildings*

The Ruhr district contains a great many derelict industrial buildings, some of which are now classed as historical and architectural monuments. These are being redeveloped as commercial, cultural and leisure facilities, in an effort to find new uses for them which will allow them to retain their industrial identity.

The insistence on retaining the existing industrial heritage of the Ruhr area runs as a central theme through all the IBA projects, and is particularly important in the landscape work. The black soil, the artificial mountains of waste material from the pots, the young undergrowth or birch forest covering rail tracks and colonising former working land are all integrated into an economical and very effective approach which does not try to deny the problems or the characteristics of centuries of industrial production.

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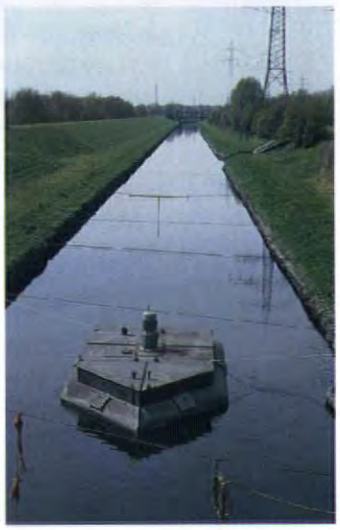

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1: Zollverein ZII, Essen. Former colliery reused as a cultural site

2: Rheinelbe science and technology park, Gelsenkirchen,

3: The existing Emscher river near Gelsenkirchen

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4: Location of the Ruhr area

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5: View from the top of a coal slag heap. The silver egs of a new water treatment plant in the background

Melbourne's monuments to the millennium

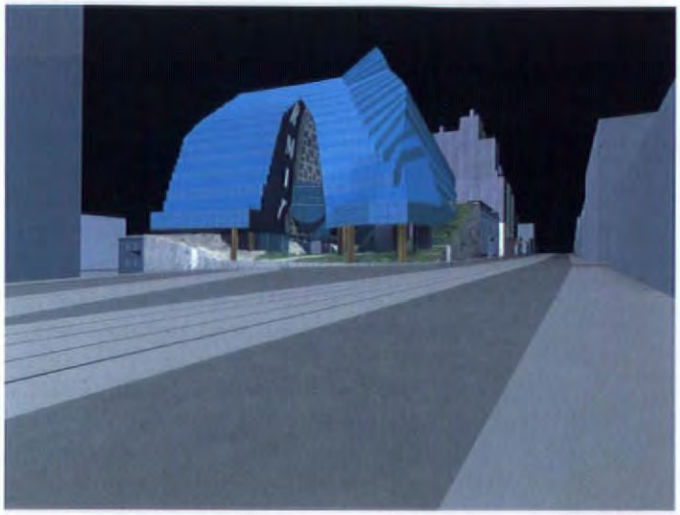
by Nicola Turner

In March this year Melbourne hosted the eighth annual Asia Design Forum, giving rise to the observation that this august event has now become as much the province of Australia's great and good as her Asian neighbours. Amongst the array of Japanese, Korean, Malaysian, Taiwanese and Hong Kong architects presenting their latest work in the decadent surroundings of Denton Corker Marshall's new Adelphi Hotel, sat several Australian designers (all from Melbourne) furiously defending the creative talent of their home town over that of their greatest rival, Sydney. And with some justification. Two architects in particular have had the opportunity to design monumental projects which define a new direction in Australian architecture for the twenty first century. John Denton, partner of Denton Corker Marshall provided striking renderings of a new "gateway" for the city, and a massive 680-metre tower built as an axial terminator towards the docklands on Collins Street.

The gateway project is part of the Melbourne City Link infrastructure project, aimed at meeting the demands of increased commuter traffic in the next century. The gateway has been commissioned as a new symbol for the city; the first identifiable landmark for visitors arriving in Melbourne. Drivers will first approach this modern urban sculpture under a cantilever and then drive past a "sound wall" of 58 coloured columns, standing 30 metres high. The effect certainly looks striking from the removed perspective of a slide projector.

The argument for and against monumentality, and architecture as an urban symbol, was continued with Denton's presentation of his slender four-sided tapering tower. Melbourne is historically opposed to tall buildings, but towers have clustered around the Central Business District over the last twenty years or so. The developer, Grollo, commissioned DCM to bring a sense of coherence and climax to this high-rise jungle, contributing the ultimate in Melbourne monuments – a fully-functional "non-building". In true monumental tradition, the tower harks back to the classical form of the obelisk, but instead of a podium at the base, four pairs of columns continue from ground level down to an eight-level car park below. If the success of a monument is judged by its clarity and legibilty DCM's Grollo tower should hit the spot. Harry Seidler designed the tower's non site-specific predecessor. That the DCM proposal is so firmly related to its context leaves the Seidler scheme in its shadow.

Carey Lyon, formerly of the dynastic Perrott Lyon Mathieson, and now set up as Lyon Architects, is currently riding on the crest of a wave. He presented his version of the monumental with a competition scheme for the Pacific Central Development, although it is not to be built. Once again the building terminates a main central street axis. The project is described by him as "a desire for a monument". The obelisk and flight of majestic steps are used to this end. By mapping the site with a grid and contours a master image is created and incorporated within a building as an "expressionist ziggurat". This more obtuse approach, whilst fascinating in a theoretical and critical context, is less immediately tangible than the DCM tower or gateway, but nevertheless demonstrates the confident design and inspired ideas that Lyon has to offer the city.



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1: Carey Lyon's "expressionist ziggurat" created by mapping the site using a grid and contours

2: Photomontage of another obelisk in the shape of DCM's four-sided tapering tower for Grollo

3: Concept sketch of DCM's gateway for Melbourne, consisting of a bright yellow cantilever and 58 coloured columns

Property and the French vote

by Michael Rowe, France correspondent

By the time this article is published the results of the two-round general election for the French National Parliament will have been announced. How are France's property markets likely to be affected by the outcome? What are the consequences for the building industry with either a right or left wing victory?

France is recovering slowly from its recession of 1993/4, and the country's property markets are still in a state of convalescence. International investors are just beginning to renew their interest in Paris real estate, and a small number of new Parisian commercial property developments are starting to come to fruition. Recent examples are the Opéra Victoire development designed by architects Jean-Jacques Ory and Ludovic Lobjoy, and the Société Générale's "Edouard VII" redevelopment project near the Place de la Madeleine.

French president Jacques Chirac took his decision to dissolve the Assembly in April. Real estate questions hardy figured directly in any of the party's election programmes, though there was some suggestion that the governing RPR/UDF coalition under prime minister Alain Juppé would take steps to reduce transfer taxes on property purchases. Under French regulations these average around 10 percent of the price of residential acquisitions and a staggering 20 percent or more for commercial property deals.

"These levels of taxation can have a significantly depressive effect on the markets," comments Robert Lipscomb of agents Healey & Baker in Paris. In addition to inflating the price for buyers, they make property holders reluctant to dispose of their holdings until market values have risen sufficiently to cover the price they paid for the property plus the tax to which they were subject on buying it.

"Although the issue has been discussed repeatedly, no government has as yet been prepared to grasp the nettle," Lipscomb indicates. The main difficulty is that French local authorities rely on property taxes for a large slice of their revenues.

More fundamental to the fortunes of French property markets and future building programmes will be the government's success in managing the recovery of the economy generally and inspiring a greater feeling of confidence in the country's still hesitant consumers and risk-averse businesses.

The RPR/UDF favour stimulating the economy by continuing to reduce public-sector expenditure as a means of cutting social charges and other costs on businesses. Deploying tax incentives as a means to encourage the creation of new businesses is a particular focus. If successful this approach could boost corporate demand for office space, warehousing and industrial premises.

The Socialist Party (PS), led by Lionel Jospin, places particular emphasis on reducing the working week, increasing salaries of the lower paid, and widening the contribution base for health service charges. The PS (which struck an election alliance with the Communist Party) also says that it would raise tax rates on higher incomes and on investment earnings. This could indirectly boost demand at the lower end of the housing markets whilst making it less attractive for individuals to buy properties to rent out.

At the same time Jean-Marie Le Pen's far-right National Front (FN) party plays a complicating role in the major parties' calculations. The influence of the FN – whose concerns centre on issues such as immigration and law and order – has been rising of late. A significantly increased vote for the FN in the Assembly elections combined with a slim majority for the winning party would put pressure on the new government to pay more attention to FN voters views and anxieties.

This could give a modern voice to an older protectionist thread in French political thinking, anti-international, anti-Masstricht, anti-big business in sentiment. And less eager to attract foreign investors in French property and other sectors.

"French people hesitate to buy property during election campaigns, even though the result will not affect their final purchasing decision one way or the other" comments Phillippe Chevalier of the Féau St Germain agency, which specialises in luxury Paris residences. "Foreign buyers on the other hand are coming back to Paris, particularly if they can find a property that offers them a picture postcard vignette of the city," he concludes.

Danielle Sucheyre

1

Pierre Baliff

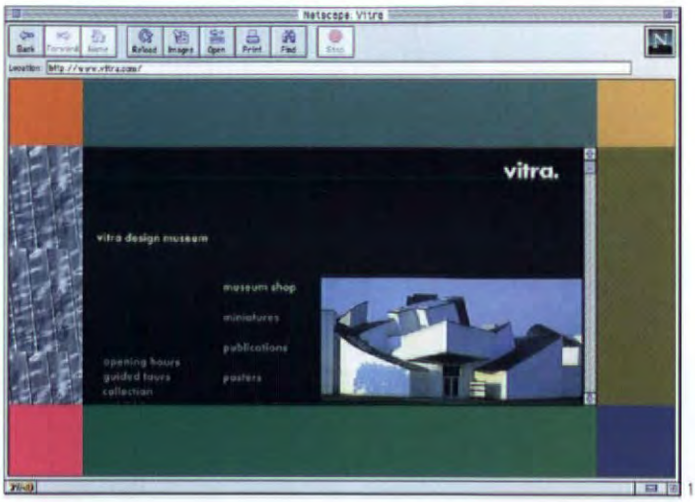
2

1: Construction of the Opéra Victoire office development in Paris is underway

2: Interior of the Opéra Victoire

OnScreen

A break from the norm: OnScreen looks at Vitra's web site, and finds that the virtues of quality and accessibility for which they are well known extend beyond their furniture design. Plus QuickTime VR and the Golden Mouse Awards.



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1&2: Vitra's web site relies on changing perimeter content to keep the pages engaging and coherent

3: Apple's cross platform QuickTime VR – bringing virtual reality to the desktop

Vitra's soft sell

Vitra's attitude to design is well known in the worlds of furniture and architecture, it's web site (http:// www.vitra.com) retains the company identity. Thankfully, unlike many commercial sites on the web Vitra is not attempting to sell anything directly, but rather give you a feel for their product. The site, effectively a showcase of Vitra's products, is akin to an elegant exhibition catalogue, though there is no hard sell, and no prices. The emphasis is firmly on the designer and his work. Vitra's products are created in close cooperation with internationally renowned designers which in the 1950s and 1960s included Charles and Ray Eames and George Nelson, and today includes Mario Bellini, Antonio Citterio, Jasper Morrison, Borek Sipek and Philippe Starck. Each designer has their own page, including photographs, biography and cross-referenced links to their furniture pages within the site.

For its own buildings, Vitra collaborates with some of the most eminent of contemporary architects, such as Frank O Gehry, Nicholas Grimshaw, Zaha Hadid, Alvaro Siza and Tadao Ando. They too have their own pages linking into informative descriptions of each building, with maps and directions and the all important opening times: how often have you arrived at some architectural gem after several arduous hours of driving in a foreign country to find it shut? The site also lists upcoming events and exhibitions at Vitra.

Down to design: the site is an excellent lesson in how to use the sometimes confusing hyper text mark-up language (hmtl) table format in a simple, elegant and effective way. Each page is based on a rectangular tabel template with nine cells.Only the centre cell used for true content, the remaining eight border cells change colour and texture as you click through the content cell, helping to link together themany diverse photographs and illustrations, giving the site a very cool, contemporary look.

As a reference source the site is invaluable for any architect or student. The only drawback is that new products in the Vitra range are not added very often, so the site could become stale over time. But in comparison with other sites Vitra's non direct approach to marketing is many seats ahead of the crowd, witness (http://www.cyberchair.com) for example. If I were not already sitting on a Vitra AC1 by Citterio, their benevolent use of cyber space might just make me go and buy one.

Just looking around

Forget expensive high-powered graphics workstations and those cyber goggles and gloves; you can now navigate the virtual world on your desktop machine with a mouse and keyboard, experience panoramic views and zoom in on details that catch your fancy. QuickTime VR is a cross platform application for Mac OS or Windows 3.1, 95 or NT that allows you to view complete 360 degree scenes generated either photographically or from within 3D modelling programs. QTVR files can be viewed either from a stand alone player application or through an internet browser with the QTVR plug-in. All of this software can be downloaded from (http://qtvr.quicktime.apple.com/) along with links to hundreds of web sites with Qucik Time Virtual Reality (QTVR) files. Images from The Whitney Museum of American Art to images of General Electrics Living Environments' concept house (http://www.crd.ge.com./esl/cgsp/ projects/le/) to my own QTVR image taken from the roof of Foster Associates new Chek Lap Kok airport (http://www2.gol.com/users/zap-kdarc/qtvr.html).

A QTVR file is surprisingly easy to make. From a series of photographs which make a complete 360 degree rotation, stitched together in a graphics program to form one long image and opened in Apple's "Make QTVR Panorama" program, a QTVR file is generated. These images can be invaluable for site analysis or presentation purposes.

Several CAD and 3D modelling programs allow you to generate QTVR images from within your computer model. ArchiCAD is one such program, and it's web site (http://www.graphisoft.com/Gallery/vrgallery.html) shows the full potential of this technology. Within the virtual world other hotspots or nodes can be embeded. Clicking on a node takes you to another world or file. For instance clicking on a door one 360 degree will take you through into the next environment. The ArchiCAD site has several examples of multi-nodes, but the virtual reality tour of The Whitney Museum of American Art (http://www.bway.net/~erikb/QTVR.html) has an amazing 29 nodes embedded in it.

Golden Mice.

Wave Digital Imaging Limited (www.asiaonline.net/wave), featured in the March issue of (*WA*54), recently picked-up several prizes at this years Intergraph Golden Mouse Awards. The image we chose to illustrate their work, a bow string truss designed by Arup Associates, won the "best of show". Wave also took four other awards, including "best architectural interior".

Mark Dytham is partner of Klein Dytham architects, based in Tokyo. He can be contacted via WA or Tel/fax: +81 3 3796 1709; or e-mail: zapkdarc@gol.com

3

Polemic

From computer aid to computer dependency

The phrase "knowledge is power" long ago became rather trite as sayings go, but where the knowledge is in computer systems, and the power is enjoyed by architects, there may still be something to learn from it.

One of the key areas of anxiety in commercial architecture today is the projected future cost of computing. At present there is hardly a sizeable architecture firm in the world that is not deeply enmeshed in a programme of updating, reorganising, expanding, restaffing, outsourcing or desperately trying to bring under control its computer operations. In the US, at those collegiate weekend retreats beloved of senior corporate architects, the hot topic is no longer a possible exit strategy from China, but the cost of keeping pace with computerisation at home. All this has come about because, over the last six months, there has been a revolution of expectations in the computer world now that is clear that falling prices will not be the same thing as cheaper operations for very much longer. Design firms may still exult over the increasing number of plotters, monitors, scanners and nicknacks that can be bought or hired for less than they cost last year, but the real computer challenge is still to come. Peering over the purchasing horizon is the cheap supercomputer, the biggest onslaught of artificial intelligence on the architectural profession since the 1950s when firms first bought primitive Bendix G-15s to handle their accounts – and found out they could do away with their accounts departments as a result. The difference this time is that artificial intelligence has it in mind to convert computer aided design into computer dependent design – a trick it has long since pulled in fields as disparate as defence and high finance.

Like many other perturbations in today's technological universe, cheap supercomputing is part of the peace dividend. During the Cold War the US government spent an estimated US$4 trillion on intelligence gathering, code-breaking and computer controlled weapon systems – far more money than any consortium of corporations, let alone professions, could have mustered for any civilian task. But when the Cold War combatants stood down, the knowledge embodied in defence activities lost its protected status overnight and it went civilian. In 1996, as part of this process, Cray Research, whose founder Seymour Cray had designed the Control Data 6600 and 7600 supercomputers to simulate nuclear explosions and crack enemy codes, was bought out by Silicon Graphics, a firm that announced its intention of turning the Cray computer, a "bespoke" product tailored to the needs of individual clients, into the basis of a saleable range of supercomputers available to anyone.

Until then, supercomputing had been a slow-growing phenomenon. The outcome of years of the pursuit of computing power regardless of cost. Supercomputers not only performed astronomical numbers of calculations per second, but related different sets of data from dozens of different disciplines so as to produce an immediate synthesis that would be totally uneconomic, or too time consuming, to obtain in any other way. Supercomputers tested hypotheses about the nature of the universe, designed supersonic aircraft, and carried out advanced studies in meteorology. Understandably the market for the kind of work they could do was confined to government departments, defence establishments, universities and major industrial corporations. That is why, even today, there are so few supercomputers in the world. According to Oak Ridge Laboratories in the US there are no more than 500 at present. But rare though they are, they are valuable too. Knowledge of the outcome of any project before it is implemented – whether it be the stretching of an airliner, or the verification of another milestone in the progress of global warming – is power indeed. The prospect of a free market and lower costs devolving this extraordinary synthesising power down to relatively small organisations, like those responsible for the design of buildings, is what is of burning interest now.

Architecture on its own is regarded as a small sector of the computer market that, until a year or two ago, thought six PCs in a LAN was the height of sophistication. Now it is about to confront the equivalent of the computational master of the universe – a machine that can handle all its supposedly mysterious variables, all its complexities, all its aesthetics, and still have enough calculating power left to take care of structural design, building services, aerodynamics, specifications, costs, codes, claims, contract management and work out the payroll too. So who will stump up the millions to be the possessors of this synchronised knowledge?

It would be nice to say "architects will", but it may not be true. Most architects are not only relatively impoverished, they make less coordinated use of their computing power than other professions in the construction industry. Structural, civil and environmental engineers spend millions on coordinated computer equipment. Several of them have their own software houses and all of them have better and more advanced computational capacity than firms of architects of equivalent size. In the same way large international construction firms invest more heavily in purchasing, contract and cost management computing than anybody else. Both these areas of expertise are compatible with each other and architects routinely rely on both. Very few architects have their own 3D CADD – with clash detection – for production drawings. Most spend what money they have, not on computation but on visualisation; on achieving dramatic visualisations and arresting images. They rarely model entire projects in 3D and rarely use the same software as other consultants.

So who will buy the new supercomputation capability that could turn any office into a total building design facility? In all probability not many architects. Instead, if they are not careful, they may find themselves confronted by construction firms and engineering consultancies looking for architectural services – for processing on their own supercomputers, of course.

Martin Pawley

"Peering over the purchasing horizon is the cheap supercomputer, the biggest onslaught of artificial intelligence on the architectural profession since the 1950s"

Book Reviews

The splendour of Reyner Banham

A Critic Writes: essays by Reyner Banham. Selected by Mary Banham, Paul Barker, Sutherland Lyall and Cedric Price. Foreword by Peter Hall. University of California Press, Berkeley. 352pp, 32 b/w illustrations. US$39.95

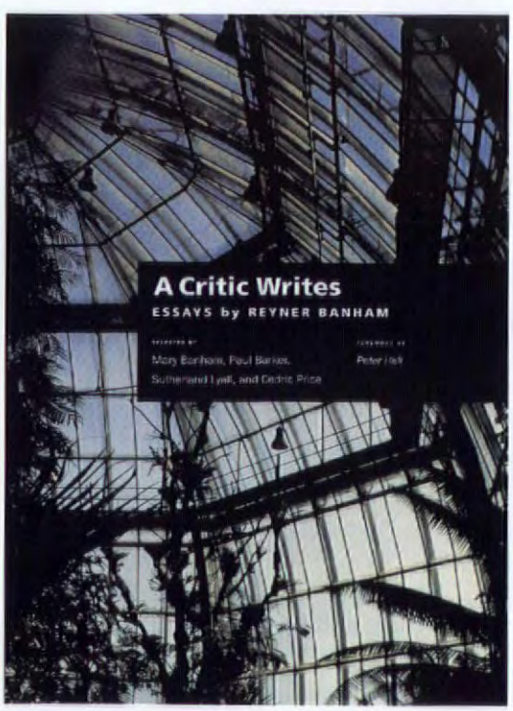
Reviewed by Martin Pawley

"The splendour (and misery) of writing for dailies, weeklies, or even monthlies, is that one can address current problems currently, and leave posterity to wait for the hardbacks and PhD dissertations to appear later." So wrote Reyner Banham in the foreword to a collection of his magazine articles selected by Penny Sparke and published in 1981. "The misery and splendour of such writing, when it is exactly on target," he went on, "is to be incomprehensible by the time the next issue comes out."

The distance in time and attitude between that anthology and this one is instructive. Peter Reyner Banham died in 1988 so the oldest of the 54 articles reprinted here was penned nearly half a century ago. Clearly we are deep into hardback and PhD time already. But the PhD-ification of Reyner Banham is obviously having peculiar results. This volume, for example, is a curiously sanitised production, typographically and design-wise austere, and heavily dosed with section introductions that are as doleful as the stations of the cross. What does this unfamiliar context do to Banham's much-admired writing? Well, for a start, the diminutive *sans serif* type face and the deracination of the original illustrations make it, for the first time in its life, rather a hard read. The articles that once jazzed up the pages of *Architectural Review* and *Art in America* now look as uninviting as court transcripts. And oh, so long! Did a typical magazine article really push 3,000 words back in the 1960s and 1970s? Apparently it did. One might also quibble with the selection of pieces – why on earth was the seminal "A Home is not a House" left out? But there is more to it than that. The truth is that the journalistic morning-after incomprehensibility Banham welcomed in 1981, plays curious tricks in 1997. Many of the pieces that bowled along in a jolly fashion in the 1960s, run a little flat in the grim anti-technological backlash of the pre-millennium.

All of this means that *A Critic Writes* resembles a book of footnotes, rather than a book, a primer to some other immense volume that has been lost, and nowadays only exists only in the mind. This lost masterpiece, comprising the enormous *oeuvre* and the wonderful insights, the memorable lecturing style and the eccentric wardrobe of Reyner Banham, the greatest English optimist of the twentieth century, is gone the way of the great library of Alexandria. It will not be conjured back into existence by such academic sobriety as this.

Martin Pawley is a consultant editor and monthly columnist of World Architecture.

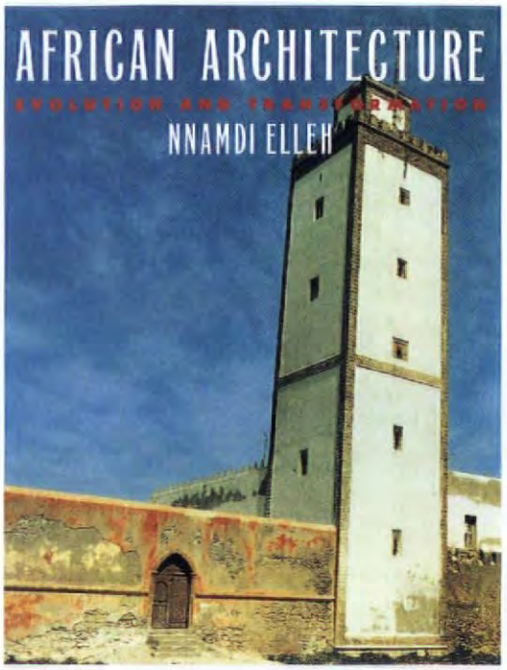


Confusion on the dark continent

African Architecture: evolution and transformation. Nnamdi Elleh. McGraw-Hill, New York. 382pp, 280 line and half tone, 100 colour illustrations. US$75/£56.95

Reviewed by Paul Oliver

There are numerous books on aspects of African architecture, but very few that are devoted to more than a regional approach, or which concentrate on more than one tradition. Nnamdi Elleh takes as a frame for the study of African architecture Ali Mazuri's "triple heritage" of the indigenous, Islamic and western elements in African history, and ambitiously attempts to cover all three aspects in a continental study divided into some 14 regions. Extensively illustrated, the book gives an initial impression of lavish production. The majority of the photographs are drawn from the American Geographical Society Collection (Milwaukee) with an emphasis on facades and a consequent lack of details. Others derive from Pelos and Bourgeois, Labelle Prussin and J-P Bourdier and Trinh T Minh-ha (misspelled throughout). There are few plans or sections and, Bourdier apart, little that expresses the volumes or the construction of the buildings. Only a handful of interiors are included – mostly of churches.



The strength of Elleh's book lies in its description of historical contexts; the chapters place emphasis on the background of indigenous culture, of westernisation or Muslim influence with a clarification of French, Portuguese, British, German and Dutch influence in urban planning, and in monumental, imperial or administrative building. Colonial architecture drew, of course from European prototypes, modified in some instances to meet climatic conditions. The future for African architecture, Elleh argues, is based on a recognition of regional traditions and he praises those "who dared to investigate the *genius loci* of the African environment and the tradition of building". He cites as an example, Justus Dahinden, whose Mityana Pilgrims Shrine to three African martyrs (a segmented parabolic dome), "is a vindication of traditional African building design and clear proof that the problem has not been with the architecture but with the hesitation of trained architects to innovate with this form".

The Bank of Economic Community of West African States by Pierre Goudiaby Atepa Architects in Dakar, Senegal, with its pyramid profile or the Sahelian forms of the ECOWAS bank at Ouagoudougou, Burkina Faso are further instances of buildings that "evoke images from African antiquity". In Elleh's view: "It is critical that the vernacular identities of each region and locality be studies and co-ordinated with building function." Given his declared position it is surprising that the lessons of Hasan Fathy's design for New Gourna, or André Raverau's medical centre at Mopti are nowhere to be seen.

It might be expected that the vernacular would be covered reliably and comprehensively. Areas and cultures which the author considers should be the subject of research are noted, though this often reflects the inadequacy of his own research. "Very little has been written on the architecture of Burundi" he states, apparently unaware of *Les Burundi* by Jean-Louis Acquier. His unfamiliarity with many of the essential books is evident from the text and the bibliography: it is remarkable to find a discussion of the Dogon (misspelled

Dongon throughout) with no reference to Griaule or Dieterlen; of Lamu without acknowledgement of the studies by Ghaidan or Donley-Reid; of Djenne ignoring Pierre Maas; of Hausa with no indication of Schwerdtfeger's work, let alone Zbigniev Dmochowski's three volume *Introduction to Nigerian Traditional Architecture*. Even that most prolific of writers on African vernacular architecture, James Walton, whose many books have been published over some 40 years, is totally disregarded. Several of these were on Cape Dutch architecture, also discussed exhaustively by De Bosdari, Lewcock and others. This, among the world's greatest vernacular traditions, is apparently unknown to Elleh.

Technical information is woefully absent, and that which is attempted is often confused or misleading. Of Calabar housing the author writes: "Sometimes the houses were pivoted (sic) above ground with columns to allow cross-ventilation". A brief description of the Chapel of Nazareth, Luanda, states that "the upper story ties to the wide base with volutes capped with pediments". Spelling errors abound, some seeming to have occurred through aural misidentification: such as the "roof supported by falked branches", "tracesories" that decorate windows, or the author "Ren A Bravemann" (René Bravmann).

Though many of the descriptions of buildings are little more than summaries of the illustrations, government buildings, city halls, university schools and libraries, banks, cathedrals and mosques are amply represented together with presidential residences and hotels. As an indication of the range of architecture in Africa this book is useful, but seriously flawed. It provides an historical foundation for a reliable and comprehensive work on African architecture, which may need to be in more than one volume and has yet to come.

Paul Oliver is a research fellow at Oxford Brookes University, UK. He is currently preparing the Encyclopedia of Vernacular Architecture of the World *for publication in October this year.*

Flip cities, nul point

Las Vegas: the success of excess. Frances Anderton and John Chase. Photographs by Keith Collie. Tokyo: labyrinth city. Noriyuki Tajima and Catherine Powell. Photographs by Keith Collie. ellipsis KÖNEMANN architecture in context series. Both 80pp, illustrated throughout. £6.95

Reviewed by Martin Pawley

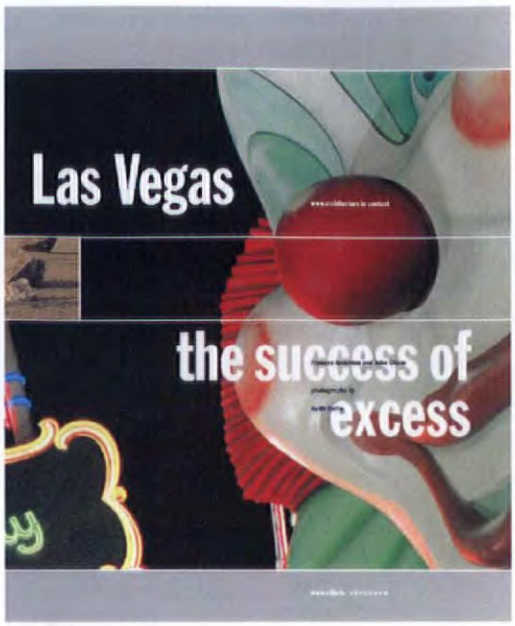
A few years ago Artemis launched a series of pocket guides devoted to recent architecture in major cities. Deservedly successful, and still in print, the number of buildings covered by these volumes is large; there are clear maps, the descriptive matter is factual and brief, they fit into the smallest pocket, and their prices are reasonable.

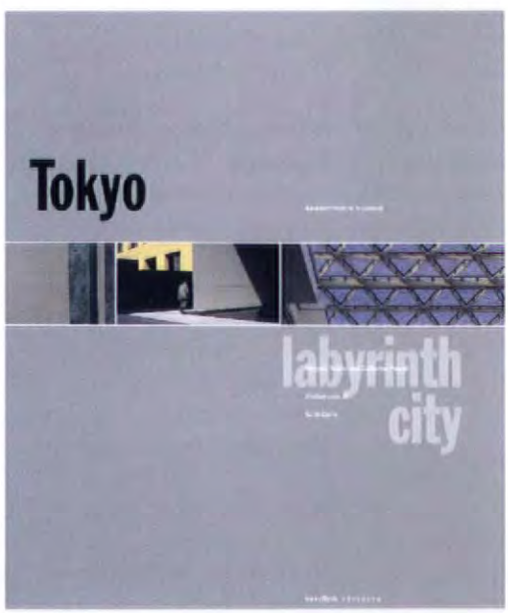
Not so with their new companion volumes "architecture in context". Here successor-publisher ellipsis KÖNEMANN has come up with a wafer-thin but aircraft carrier-wide book format that not only doesn't fit your pocket, but won't fit your book case either. Daringly avant garde, these volumes boast no contents pages and no indices. The number of buildings covered in each is minuscule, and the maps are either uninformative or non-existent – as in the case of Tokyo. Worse still, the scattered patches of trilingual text read with all the banality of entries in the Eurovision Song Contest, oscillating between knowingness and vapidity.

A typical passage in the Las Vegas volume describing a casino runs; "'Drink... and Eat Too!' is a dive themed on the notion of drink" (implying that this is a notion that could be discussed for hours). Even better, because of its jejune use of a famous name is; "Lighting is the form-giver in Las Vegas. This is in contrast with the rest of the world where, as France's Jean Nouvel has remarked, 'One thing they seem to have forgotten in architecture schools is that this century we discovered electricity'".

Unfortunately, the Tokyo volume is even more scrappy and vacant than this, although it must be conceded that the buildings are more interesting. Itsuko Hasegawa's Sumida community centre, for example, is superbly photographed, but the imagery is let down by Noriyuki Tajima and Catherine Powell's text, which assures the credulous reader that the users of this building are "strikingly positive and eager to combine the latest media technology with their traditional communal activities". These are clearly the sort of building users that architects need, and not only in Tokyo.

The only relieving feature in either of these volumes is Keith Collie's excellent photography – although even this is marred by the poor standard of reproduction and heavy handed design.





BOOKS RECEIVED

Dan Graham Architecture

Texts by Dan Graham, Brian Hatton, Mark Pimlott and Adachiara Zevi. AA Publications, London. 64pp,15 colour, 15 b/w illustrations. £15 (paperback)

The American Landscape

Christian Zapatka. Princeton Architectural Press, New York. 216pp, 50 colour and 210 b/w illustrations. US$35/£24 (paperback)

The Critical Landscape: the Stylos series

Arie Graafland, Jasper de Haan. Uitgeverij 010, Rotterdam. 256pp, 100 illustrations. NGl39.50/£18.50 (hardback)

Reflections on Architectural Practices in the Nineties

Edited by William S Saunders, with P Rowe, M Scogin, K M Hays, C Burns and R Ferris. Princeton Architectural Press, New York. 272pp, 80 b/w illustrations. US$18.95/£13.95 (paperback)

Events

Lectures, Congresses and Conferences

Australia

Biennial Oceanic Architecture and Design Student Conference

International student conference to be held at Deakin University, from 6-11 July 1997. Contact Carlie Spiteri, School of Architecture and Building, Deakin University, Woolstores Campus, Geelong, Victoria 3217, Australia.
Tel: +61 3 5227 8364
Fax: +61 3 5227 8365
e-mail: morphe@ deakin.edu.au.
Web: www.ab.deakin.edu.au/ morphe /morphe.html

Brazil

São Paulo Conference on High Technology Buildings

A Council for Tall Buildings and Urban Habitat (CTBUH) endorsed conference to be held at Maksoud Plaza Hotel, São Paulo from 30-31 October 1997. The conference will focus on the common ground between educational theory and actual practice in the fields of building technology and urban development. Contact Edison Musa, vice chairman of CTBUH at Av Princesa Isabel, 323 5° andar, 22011-010 Rio de Janeiro, RJ, Brazil.
Tel: +55 21 275 32 46
Fax: +55 21 542 33 44

Bulgaria

INTERARCH 97 VII World Triennial of Architecture

Organised by the International Academy of Architecture (IAA) and the Union of Bulgarian Architects, the Triennial will consist of a symposium – on architectural education in the twenty-first century – and an exhibition. From 23-29 June 1997 at 2 Tzar Osvoboditel Blvd, Sofia 1000, Bulgaria. Contact Milka Kostourkova.
Tel: +35 92 9872931/9871313
Fax: +35 92 9877165

Canada

Underground Space: Indoor cities of tomorrow

The seventh international conference on underground space and facilities, to be held in Montréal, Canada. 29 September-3 October 1997. For further information contact the Organising Committee, City of Montréal, 303 Notre-Dame Street East, 5th floor, Montréal, Québec, Canada H2Y 3Y8.
Tel: +514 872 8334
Fax: +514 872 0024
e-mail: 7econfso@odyssee.net

Finland

Habitat Inspirations 97

Seminar organised by the Finnish Association of Architects (SAFA) focussing on issues of contemporary urban design in relation to to evolution of sustainable solutions to housing in both developed and underdeveloped countries. Running from 13 to 15 September, the final day is dedicated to glass in modern architecture. Contact the SAFA at Yrjönkatu 11A, 00120 Helsinki, Finland
Tel: +358 9 584 448
Fax: +358 9 601 123
e-mail: liitto@safa.fi

US

A Time to Reflect – A Time to Challenge

The Waterfront Center's fifteenth annual international conference on urban waterfront planning, development and culture takes place at the Hilton Hotel and Towers, Baltimore, Maryland, US from 16-18 October 1997. For information contact Jackie Conn.
Tel: +202 337 0356
Fax: +202 625 1654
e-mail: waterfront@mindspring.com

Architecture and Design Competitions

Argentina

Design of the Costantini Museum, Buenos Aires

UIA-endorsed, one phase international competition to design a new museum to house Eduardo Costantini's collection of Latin American paintings – the structure will also hold temporary exhibitions and other collections. Deadline for the reception of applications, 27 June 1997. The jury will sit from 4-8 October. The winning proposal will be announced on 14 October. Contact Comision del Concurso Museo Costantini, Madero 900, piso 28, 1300 Capital Federal (Buenos Aries), Argentina.
Tel: +54 1 318 80 00
Fax: +54 1 318 80 01

Czech Republic

The Prague Castle Pheasantry Redevelopment Project

The Prague Castle Administration have announced the first stage of a major open international competition for the redevelopment of the former Pheasantry garden and the adjacent buildings of the Court of the Riding Hall situated at the northern approach to Prague Castle. Submissions for the first stage are due by 15 August 1997. For further information contact Jan Zemánek, AYH HOMOLA Projektmanagement sro, nám Barikád 1134/3, 130 00 Prague 3, Czech Republic.
Tel: +42 2 697 00 24
Fax: +42 2 697 20 15

Finland

International competition for a Music and Arts Centre in Jyväskylä, Finland

The City of Jyväskylä have organised an architectural design competition for a new Music and Arts Centre, to coincide with the 100th anniversary of Alvar Aalto's birth. The competition is open to architects from all European Union (EU) countries, as well as certain others. Registration until June 1997. Deadline for entries 15 September 1997. Total prize money $US150,000 (FIM 750,000). For further information contact the competition secretary at The Finnish Association of Architects, Yrjönkatu 11A, FIN - 00 120 Helsinki, Finland.
Tel: +358 9 584 448
Fax: +358 9 601 123

US

Good Design Awards 1997

The Chicago Athenaeum: Museum of Architecture and Design have announced the 1997 Good Design Awards – an exhibition of competition entries is scheduled for show from October this year. The awards welcome industrial and graphic designs from around the world. All entries must have been designed/manufactured since January 1995. The deadline for submission is 1 July 1997. For an entry form contact Leonard Kliwinski.
Tel: +312 251 0175
Fax: +312 251 0176
Web: www.chi-athenaeum.org/.

11th Annual Excellence on the Waterfront Awards

The Waterfront Center have announced that the deadline for entries in their programme to promote creative solutions in the conversion of abandoned or outmoded waterfront territory is 15 August 1997. Contact the Waterfront Center at, 1622 Wisconsin Avenue NW, Washington DC 20007, USA.
Tel: +202 337 0356
Fax: +202 625 1654
e-mail: waterfront@mindspring.com

Exhibitions

France

Made in France: 1947-1997

The last exhibition at the Pompidou before its closure for internal reorganisation looks back on 50 years of French design. Until 29 September. For further information contact the Centre Georges Pompidou, Paris, France.
Tel: +33 1 44 78 12 33
Fax: +33 1 42 78 50 59

Germany

Castiglioni and Italian design

The "Castiglioni" exhibition showcases objects and sketches illustrating the creative cycle of the designer whose name has become synonymous with modern furniture and furnishing design. The exhibition runs until August 1997 at the Vitra Design Museum, Weil am Rhein, Germany.
Tel: +49 7621 7020

Sweden

Rafael Moneo

An exhibition of the architect's designs for the new Swedish Museum of Architecture and the new Museum of Modern Art, in Stockholm, Sweden. Until 10 February 1998. Contact Catharina Siegbahn at Arkitektur Museet, Skeppsholmen, S 11149 Stockholm, Sweden.
Tel: +46 8 463 0500
Fax: +46 8 611 47 61

Brilliant Failure – Aspiration and Reality

The Austrian Museum of Applied Arts (Österreichisches Museum für angewandte Kunst) present an exhibition of Austrian architectural developments that remained on the drawing board. From pre-Ringstrasse urban planning projects, to Otto Wagner's refined classicism the exhibition runs until 6 July 1997, at Stubenring 5, A-1010 Vienna. (Pictured above is a design sketch from Adolf Loos' unbuilt proposal for the Chicago Tribune Column, 1922.)
Tel: +43 1 711 36 233 Fax: +43 1 713 10 26

Trade Shows

UK

Portable Architecture
An exhibition focussing on a form of architecture that can respond to a constantly changing world. Runs until 5 July 1997 at the Royal Institute of British Architecture (RIBA), 66 Portland Place, London W1N 4AD, UK.
Tel: +44 171 580 5533
Fax: +44 171 637 5775

The Power of Erotic Design
An exhibition, designed by Nigel Coates, of the erotic in twentieth-century culture, from Freud to Madonna. Runs until 12 October 1997. Design Museum, Shad Thames, London SE1 2YD, UK.
Tel: +44 171 403 6933
Fax: +44 171 378 6540

Celebration of the Arts and Culture of Yemen
The Yemen Festival, beginning on 18 September 1997 and running through October at the Royal Institute of British Architecture (RIBA), London celebrates the architectural heritage and culture of the second largest country in the Arabian Peninsula. The exhibition has been designed by Fashion Architecture Taste (FAT). RIBA, 66 Portland Place, London W1N 4AD, UK.
Tel: +44 171 580 5533
Fax: +44 171 637 5775

US

Proposals for the new Modern Art Museum of Fort Worth
Models and drawings of design proposals for Fort Worth's new modern art building will be on public view at 1309 Montgomery Street at Camp Bowie Boulevard, Fort Worth, Texas 76107, US throughout the summer. Submissions were invited from Tadao Ando, Richard Gluckman, Arata Isozaki, Carlos Jiminez, Ricardo Legorreta and David Schwarz.
Tel: +817 738 9215
Fax: +817 735 1161

France

Batimat 97 and Interclima 97
The twenty-first annual building and construction exhibition runs from 3-8 November 1997 at the Porte de Versailles and Paris-Nord Vilepinte, France. Contact Gerrard Whitty at Promosalons (UK) Ltd.
Tel: +44 171 221 3660
Fax: +44 171 792 3532
In France contact Valerie Moullec.
Tel: +33 1 47 56 50 00
Fax: +33 1 47 56 08 18

Kazakstan

KAZBUILD/KIPS 97
KAZBUILD 97, Kazakstan's fourth international building, construction and interiors exhibition will be run in conjunction with KIPS 96 – protection, security and fire safety exhibition – at the Atakent International Exhibition Centre, Almaty, Kazakstan from 3-6 September 1997. For further information contact Irene Batsieva.
Tel: +7 3272 509 390
Fax: +7 3272 509 391

The Netherlands

Meubelbeurs/INTEROFFICE
International furniture fair and office furnishings exhibitions. Run from 31 August-3 September 1997 at the Royal Dutch Jaarbeurs, Utrecht, the Netherlands. Contact Victoria Littlewood at the Overseas Tradeshows Agencies (UK).
Tel: +44 171 486 1951
Fax: +44 171 587 3480
In the Netherlands contact Mrs A Van Beuuren
Tel: +31 30 2955 2686
Fax: +31 30 2955 870

The Philippines

Build Expo/ISST 97
A showcase of the latest products and services available in the expanding Filipino building and construction market. The event will run from 3-6 September 1997 in the Philippine International Convention Centre, Manila, the Philippines. Contact David Aitken of Reed Exhibition Companies (UK).
Tel: +44 181 910 7744
Fax: +44 181 910 7749
In the Philippines contact Evelina Estrada.
Tel: +63 2 891 6247

Singapore

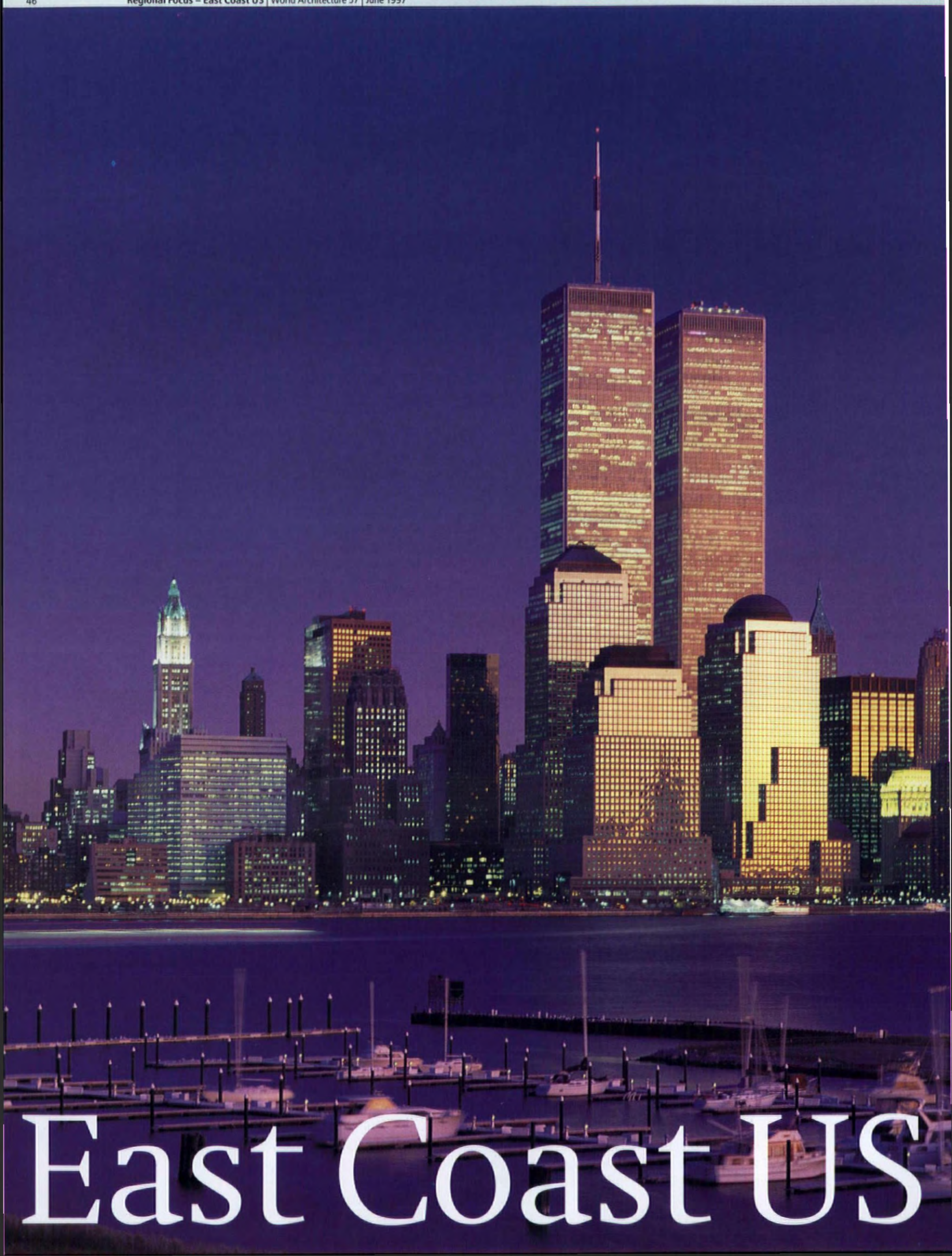
MIPIM Asia
The first MIPIM Asia will take place at Suntec City Convention Centre, Singapore from 16-18 September 1997. The event is expected to attract all the key developers, local authorities, property advisers, architects, service suppliers, institutional and private investors in the Asia Pacific region. Contact Reed Exhibitions Pte Ltd, N° Temasek Avenue # 17-01 Millenia Tower, Singapore 039 192.
Tel: +65 338 2002
Fax: +65 338 2112

South Africa

AFRIBUILD 97
South Africa's largest business-to-business exhibition for construction, building and related industries. Runs from 5-8 August 1997 at the Gallagher Estate in Midrand, near Johannesburg, South Africa. Contact David Aitken or Sam Carter of Reed Exhibition Companies (UK).
Tel: +44 181 910 7744
Fax: +44 181 910 7749
In South Africa contact Nigel Walker.
Tel: +27 11 886 3734

Ukraine

KIEVBUILD 97
The first Kiev international building and construction exhibition. Runs from 17-20 June 1997 in the Sports Palace, Kiev, Ukraine. Contact Alejandra Sarmiento of International Trade and Exhibitions Group – Construction Group (UK).
Tel: +44 171 286 9720
Fax: +44 171 286 0177
e-mail: building@ITE-Group.com
In the Ukraine contact Taras Kostyuk of Primus Ukraine.
Tel: +380 44 564 9861
Fax: +380 44 564 9663



East Coast US

Peter Aaron/Esto

Regional Focus

America's recession in the late 1980s had serious consequences for the architectural profession up and down the East Coast, with a fallout that continues today. The sustained 1980s boom that finally bust occurred largely in the urban speculative office market. The combination of a weak national economy, a weaker regional economy, overbuilding in East Coast cities and a dive in the level of rental prices conspired to stop the office developments that formed the bedrock of many overheated practices. Joseph Giovannini reports on how even the major firms have had to adapt to the economic climate of the 1990s. Hanscomb Associates provide a construction factfile.

The East Coast of the US is responsible for 37% of the US total construction put in place. Shown here, a view of New York City, the heart of the East Coast

For those architectural firms on the East Coast of the US that stayed open during the economic hardship of the1990s the fierce competition for the few jobs drove fees down, straining the ability to retain levels of quality and suppressing pay scales throughout the ranks. Unlike the flush 1980s the climate became very competitive: "The rush to undercut fees was truly horrendous," says John Winkler chief executive officer of Skidmore Owings and Merrill (SOM). The crisis forced many firms to change their *modus operandi*, diversifying in both markets and building types. "In the mid-1980s, we found ourselves doing eight buildings, all over sixty storeys, all over one million square feet, and one day we realised we had to diversify" says Fred Clark, a partner in Cesar Pelli and Associates. "Even before the recession hit we turned down office building work and started taking modest commissions for schools and colleges, to retool our whole process. Our work at Rice University introduced us to another kind of client, the kind that does performing arts centres and large-scale masterplans. These were not fancy or high-fee projects. Firms like ours worked hard to rebalance the allocation of work between public and private clients. The net result was we were able to have a stable office of about 65 architects, without any big layoffs."

Geographical diversification accompanied diversification in building types. "We all went to Asia, because the big urban mixed-use projects were in Tokyo, Singapore, Kuala Lumpur, Jakarta" says Eugene Kohn of Kohn Pedersen Fox (KPF). "We went because we got invited, but once there realised it was a strong market, and still is – though Bangkok, Jakarta and KL may be overbuilt. Had we been dependent on the East Coast for our work, particularly the New York-New Jersey region, we would not now be very busy and we would have had a ten-year drought."

"Last year over 53 percent of our work was outside the US" confirms Winkler. Being based on the East Coast, particularly in the Northeast on the Boston-Princeton axis, has given certain firms a competitive edge in the international arena because of the rub-off of prestige from the country's most prominent architecture schools. The global perception is that this region is the Athens of the US and nurtures an unmatched talent pool that constitutes the essential architectural culture in the country, East Coast offices have also been attractive to developers abroad doing high-rise projects because the building type is a US invention and remains an American expertise (though not exclusively) and because US architects are perhaps best attuned to the requirements of American corporations, which foreign developers want to attract as tenants.

Perhaps it was not surprising that nationally and internationally famous architects simply stayed on the jet, but what was unexpected about the pursuit of international work was that many local and regional architects have become international without ever having been established at home. "The coupling of the recession and the Asian markets caused local and regional firms to go international before going national" says Kohn. "I don't think going straight from a local/regional to an international has ever happened before. And they return regional rather than national, because their local markets are getting busy".

While national firms focused on international prospects, they relinquished their hold on regional markets, allowing local architects to assert themselves on their home turf. "Firms in cities like Atlanta had watched us take all their work, and during the recession, they had occasion to renew local friendships. Regional architects were there while these clients were sorting things out, positioning themselves to compete when the market came back," says Clark. "So naturally, now that Northern Florida, the Carolinas and Georgia are experiencing localised real estate booms, and are ahead of most other places in doing developer buildings, the regional architects, who have become ferocious competitors, are being hired."

A firm like SOM, with major offices in New York, Chicago, San Francisco, and smaller offices in Los Angeles and Washington DC stayed a national firm that emphasised its regional presence. "Never did we lose our focus on the United States" says Winkler. "The foothold for all those offices has to be in the region where they're located. Skewing an office with too much foreign work is unhealthy."

Atlanta became a microcosm of the regionalisation of East Coast practice, as firms like Heery International, which had been associate architects to national firms in the Northeast, resituated themselves and emerged in leadership positions. "When the shakeout occurred and we went other places, tried other building types, and took our eyes off those markets, the regional architects – who lived there and regularly saw the developers who some day would come back and build again – stepped into the vacuum," says Clark. "They spotted the opening, and they moved on it."

"For national architects, it's become tougher, while things have improved for the regional architect" says Kohn. As for international architects coming in to the US, this is relatively unusual. The East Coast is really an export rather than an import market. Christian de Portzamparc from France has designed the prestigious Vuitton headquarters for 57th Street, but with two storeys of steel up construction has stopped. The Museum of Modern Art has just staged a splashy international competition for its expansion, with two Japanese (Ito and Taniguchi), two Dutch (Koolhaas and Arets) the Franco-Swiss American Tschumi, and one Swiss firm (Herzog & de Meuron) on the list of ten.

"The coupling of the recession and the Asian markets caused local and regional firms to go international before going national. I don't think going straight from a local/regional to an international has ever happened before."

1

Richard Gore

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1: Although 53% of SOM's work was overseas in 1996, it still has a strong presence on the East Coast. Shown here: the Islamic Cultural Center of New York

2: Heery was responsible for the first major speculative office tower to be constructed in Atlanta in the last five years, Equitable Real Estate's new Monarch Tower

REGIONAL FACTFILE

The East Coast of the United States of America (USA) is comprised of 17 states and includes the nation's capital. It is generally grouped into the regions: New England – Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont; Middle Atlantic – New Jersey, New York, Pennslyvania; South Atlantic – Delaware, District of Columbia, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, West Virginia. The land area of the East Coast is 1,160,659 square kilometres, about 12% of the total land area of the US.

Population: Around 98 million, (37% of the total US population). Seventy five percent of the population live in urban areas. Population density is 84 people per square kilometre and the US population density is 28 people per square kilometre. A population shift is occuring from the more densely populated Northeast and North Central US to the West Coast and the South.

Number of architects: It is estimated that East Coast design firms represent about 40% of the total number of firms in the US, which is estimated at 15,000.

Language: Predominate language spoken is English although there is no official language.

Time difference: The East Coast of the US is predominately in the Eastern Standard Time (EST) zone, which is five hours behind Greenwich Mean Time (GMT). A small portion of Florida is six hours behind GMT.

Currency: US dollar ($) divided into 100 cents.

National holidays

New Years Day	*January 1*
Independence Day	*July 4*
Christmas Day	*December 25*

The following holidays are observed on different dates each year:

Martin Luther King Day	*Third Monday in January*	Labor Day	*First Monday in September*
President's Day	*Third Monday in February*	Columbus Day	*Second Monday in October*
Memorial Day	*Last Monday in May*	Thanksgiving Day	*Fourth Thursday in November*

Airport information: Major cities have an international airport, and a vast number of domestic flights make local air travel readily accessible.

Dialling code: The US's country code is 1, and the dialling out access code for an international call from the US is 011.

Regional markets

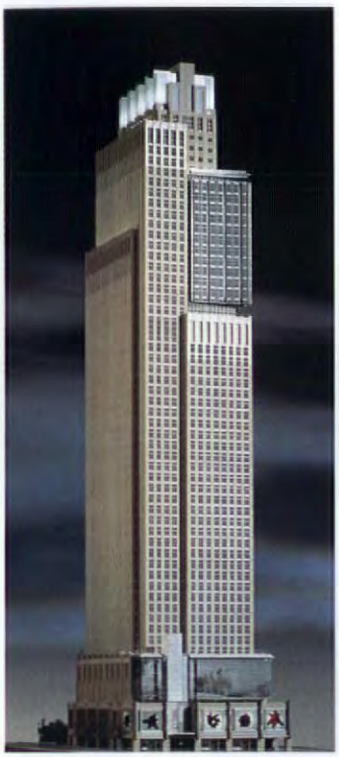
The East Coast is a monolith in name only, financial forces acting unequally in regions as well as subregions. Urban and suburban developments are both flourishing in the Southeast, which has had a quicker recovery form the recession than the Northeast (north Florida behaves like Alabama and Georgia). Atlanta's comeback was driven by the 1996 Olympics, and has continued even after the Olympics. Southern Florida behaves more like Latin America, and Miami especially has benefited from South American investment (when things are healthy in Brazil, they're healthy in Miami). South Beach particularly has grown with entertainment as a major attraction.

In the economic realignment of the East Coast following the recession, North Carolina has become one of the banking magnets of the US. Nationsbank is headquartered in Charlotte, and having aggressively absorbed many American banks that faltered during the recession because of bad real estate loans, it has consolidated its leadership position as the third or fourth largest bank in the US (its leaders are intent on remaking Charlotte as a world-class city). Wachovia Bank and First Union are powerful economic engines in Winston Salem, North Carolina, which itself is near the Raleigh-Durham Research Triangle (see building review of the North Carolina State Engineering Graduate Research Centre, Raleigh). The region consistently tops lists of the most liveable areas in the US, a ranking that fuels its growth.

Washington D.C has come back to architectural life because its status as national capital makes it somewhat recession-resistant: brigades of attorneys, lobbyists, think-tank and trade groups need housing, offices and stores, and they patronise restaurants and cultural institutions. Through the general Services Administration, Washington also fed many firms in the early 1990s – KPF had six major commissions in that period, and though the rate promises to decline, there will always be commissions for America's growth industry, courthouses and jails.

"I think New York, because it's become again a very exciting and even safe place, is going to get some major office buildings over the next three or four years," predicts Kohn – "two to five office buildings, starting at the end of the century and finishing the beginning of the next." After nearly ten years of suspended animation, ground has been broken in Manhattan for the first major highrise – the 1.6 million-square-foot 4 Times Square. Experts predict KPF's Rockefeller Center West, designed a decade ago, will finally get built.

Boston, whose office market became overbuilt in the 1980s, rebounded two or three years ago – first as a place for public buildings such as Pei Cobb Freed's federal courthouse, and now for hotels and office buildings. Its resurgence is due primarily to the hi-tech corridor ringing the city, the Northeast's equivalent of Silicon Valley. Boston remains a ›



Pottle

1

"Without question what's called 'entertainment retail' – movies, health clubs, theme stores and restaurants – is the biggest force in development today and has been for the last couple of years."

Eric Schiller

2

1: Ground has been broken in Manhattan for the first major highrise – the 1.6 million-square-foot 4 Times Square for nearly ten years. Experts predict KPF's Rockefeller Center West, shown here, designed a decade ago, will finally get built.

2: Pei Cobb Freed and Partners' US Courthouse and Harborpark in Boston, to be completed in 1998

› difficult place for out-of-towners to build because of the high density of local architectural firms and the depth of talent coming out of the many architecture schools.

Building types

"Without question what's called 'entertainment retail' – movies, health clubs, theme stores and restaurants – is the biggest force in development today and has been for the last couple of years," says Kohn. "You see it not only in new shopping malls but in the upgrading of existing retail facilities – just look at Fifth Avenue and 57th Street. Disney, Warner Brothers and Sony are all sponsoring growth in that industry, and it's big all over the country, but especially in Florida and increasingly in New York." The architect predicts a good market for educational institutions – public schools and universities – and for city and state courthouses. "Trouble is, a lot of architects are competing for them." Though the demand for corporate headquarters has been flat because of downsizing and accountability to shareholders, he predicts that new technology, changing office concepts and continuing environmental concerns will spur an increased demand for corporate headquarters by the end of this century. "When you work in energy-efficient, environmental ways, the payback is much quicker," says Kohn. "These concerns will make it wiser and more intelligent to make new buildings that will be more economical, as they deal with new concepts in the work environment – including working at home and the open-office environments. We're now finishing the IBM headquarters, a building that defines the turn of corporations toward a leaner, meaner culture."

With pressures on existing capacity and the advent of new technologies, transportation infrastructure promises to be another growth area. "On the East Coast, we've been fortunate to have transportation projects," says SOM's Winkler. "We've been involved with upgrading Logan Airport in Boston, and JFK in New York, and the expansion of Dulles in Washington. It's only a matter of time until there will be more airports in the whole Northeast corridor."

The return of urban office buildings has been slow for several reasons. East Coast cities including New York, Philadelphia and Boston were overbuilt during the time corporations downsized, and the rents dropped below what it takes to build a new building. Construction costs have come down from what they were in the 1980s, but the decrease is still insufficient (coupled with the land value) to build a competitive structure. Today the office market (along with retail and multi-family housing) is dominantly suburban because of the prohibitive cost of land and construction in downtown areas. The ever-oscillating love-hate relationship with cities seems currently to be in its pre-suburban phase, where the building sizes – 100,000 to 150,000 square feet – happen to be more easily and inexpensively funded and leased. "You can't built that in an urban environment, it's too small a chunk," says Kohn, "so you go outside the city, and that's what's happened in Atlanta, Charlotte, Boston and Philadelphia. The suburban office building is back in favour. That market is also getting stronger around New York, on Long Island and in Westchester. In Connecticut, Stamford has become a very strong market – I would say that per capita it's probably the strongest market in the East, led by Swiss Bank and others."

Because rent levels drive new construction, their poor performance militated against new urban buildings in the early 1990s, and the main real estate activity within cities like New York, Boston, Philadelphia and Washington has been the purchase and upgrade of existing buildings. "Renovation is a lot cheaper than building new, either because you can't build

back the volume that's there, or you have a great location and the renovation is less expensive, even if it produces less absolute rent than new construction," continues Kohn. "Renovating existing buildings, either from the interior point of view – core, elevator, toilets, AC – to reskinning has been the major work we have seen in the last several years."

For several years the national economy has been on the mend, and with an excruciating delay, the real estate market has been coming back, led up and down the East Coast by a bull financial market. "Our work from Boston to Atlanta, beyond transportation, is largely in the financial services industry," notes Winkler. "In the past ten years or so, we've done 20 million square feet for financial services, from highly finished customer contact areas to trading space." The argument might be made that the recession has actually helped interior work. "Interiors have been an enormous part of our practice, running 33 to 38 percent," says Winkler. "Twenty-five percent of the rest of our work has been transportation."

In addition to the sheer robustness of finance and law, the demand for interiors has resulted from pent-up need, the voracious presence of technology in the office and office-to-office moves made in response to downswing and upsizing. Many relocations were made simply because of better deals – fluctuations in price cause the musical chairs of firms hopping from one rent to another. "If you're in the development business, you weren't building buildings in Washington or New York," says Margo Grant of New York's Gensler, whose practice is primarily corporate interiors. "In Washington and New York, we saw phenomenal growth in the last ten years, especially from late 1990 to 1992, then gaining more momentum in 1993. Our volume over the last several years has more than doubled, with a lot of business in New York from foreign banks – Swiss, French, English. I've seen more foreign entities come to New York in the last three or four years than in all the time I've been in the office, and in the last six months, corporations have been looking for big blocks of spaces. Business is so technologically driven, a lot of firms need to upgrade. We do very few corporate headquarters."

"As I see it, speculative commercial is growing faster in the south than in the north, and faster in the suburbs than the city," observes Winkler. "But urban centres have the ability to generate such enormous projects that when they do happen, even on a smaller scale, they skew the percentages dramatically. So although it hasn't happened, I think it will. There are projects and studies and competitions that we've entered for urban centres on the East Coast. It's about to break."

Restructuring

While reinventing their business strategies, many firms have also restructured their organisation. "From the early 1990s on we've looked at different markets, and under the umbrella of the firm we cultivated specialities to help us compete in niche markets," says Winkler. "We now have individual departments within the firm – an airport transportation head who's responsible for that work, for example – as we do for convention centres and philharmonic halls. We've held together the teams so the expertise ›

3: Washington National Airport, near the city centre, by Cesar Pelli and Associates. Part of a US$1 billion Capital Development Program for the airport. Completion this year

4: Dulles Airport, also Washington, by SOM. Much of its work is in transportation and includes Logan Airport, Boston and JFK, New York

5: The exterior of Pelli's Washington National Airport is clad with clear, patterned and spandrel glass with a painted aluminium mullion system

3

Jeff Goldberg/Esto

4

Jeff Goldberg/Esto

5


1

2


3

Christopher Little

Matt Wargo

1: Hardy Holzman Pfeiffer's famous Windows on the world restaurant, on the top floor of one of New York's World Trade Centre twin towers

2: Venturi, Scott Brown and Associates' Trabant University Centre, University of Delaware, Newark

3: Refurbishment is a booming sector. For Mutual of America Life Insurance in New York, Swanke Hayden Connell have reconstructed an office tower, incorporating one and a half times as much floor space as would be allowed in a new building on the same site

› remains intact, and we go out and compete in a specialised way. In the past, we were more casual about out expertise, and teams would be divided, and we'd lose our glossary of terms, the context, and all that it meant to be focused. The reorganisation we did during the recession helped us a great deal."

Working in the global market on numerous projects has necessitated the growth and merger of already large firms, such as Gensler, SOM, and Perkins and Will Russo Sonder, which has also meant staffing with numerous senior associates to represent the work abroad. But KPF invented a different organisational strategy, downsizing while taking on more work. "We were overstaffed for the way we were working," says Kohn. "There were too many layers. The way work is done overseas, you don't do as many working drawings and we were doing working drawings but calling them design development. So we're trying now to find a more efficient way of operating that still produces great design, and lets us work in two camps – to compete with well-known single-name architects and with larger firms for the larger projects. We're kind of in the middle, with a structure and identity that allows us to do a 5,000-square-foot house [in Vermont] and a 5-million-square-foot building [in Nagoya, Japan]. We're mid-size, and I hope it's going to work well. We're trying to be organised in discrete teams that are small tight and very experienced. We are trying to be perceived in two different ways, to go against Venturi and Meier on the one hand, and against HOK on the other. Each requires a different strategy and thought process."

Flowing regional work through computers makes the firm both national and international, giving the regional offices extensive backup. Though the New York office, for example, may specialise within the metropolitan area, giving it a detailed grasp of its home terrain, the computer diffuses operation into a network. Not only is the client base of the whole firm simultaneously regional, national and international, so is the production base.

The client base of signature architects is dominantly institutional, and has been somewhat recession resistant. Nonetheless, Meier does not have many projects on the East Coast. Venturi has recently seen several projects slip out of his office, such as the Staten Island ferry terminal in Manhattan and a symphony hall in Philadelphia, for reasons that do not have to do with the economy.

The immediate prognosis for architectural practice on the East Coast is sanguine. The American economy is strong, and the East Coast, with a slight lag, is almost as hearty. All eyes are on interest rates: with the threat of inflation, they tighten and there will be a slow down. Still, most architects find optimism in a slow and steady growth tied into rising corporate profits, the need for corporate space and escalating city rents. Firms, however, are no longer depending on their local and national markets and are already scanning the stock market positions in Asia to suss out absorption rates and divine the next venue of operations. Some think it's India. Others are looking south, to Chile and Brazil.

Regardless of the place, the strategy learned over the last decade is diversification. The hope and assumption is that if a firm juggles several building types in several markets the differing activities will be out of phase with each other and never down cycle at the same time. WA

CONSTRUCTION FACTFILE compiled by Hanscomb Associates

Industry overview: The 1992 Census of Construction prepared by the Bureau of Census compared the East Coast construction industry to the whole country. The East Coast had over 220,000 construction establishments – approximately 40% of the US total; about 1,750,000 employees – approximately 37% of the US total, and almost US$194 billion in construction put in place – approximately 37% of the US total.

Economic data

Consumer Price Index:
1990=100

1991	104	**1994**	113
1992	107	**1995**	117
1993	111	**1996**	120

Exchange Rates:
US$ = 1.00

	UK	Germany	Japan
	£	DM	Yen
1991	0.535	1.52	125
1992	0.661	1.61	125
1993	0.675	1.73	112
1994	0.640	1.55	100
1995	0.645	1.43	103
1996	0.595	1.55	115
1997 (Mar)	0.626	1.68	123

Construction outlook: Estimates of the regional market for the East Coast: institutional 30-35%; office/commercial 20-25%; residential 15-20%; industrial 3-5%. The renovation market is much stronger in the northern East Coast states than elsewhere.

Rates of inflation: The 1997 rate of inflation for the building industry is estimated to be between 3 and 5%

Construction procurement: There are three "families" of ways that a project can be put together:

- *Traditional* – where an owner hires a firm of architects and/or engineers to design the project. Designs are taken to a complete level of detail including specifications. Bids (tenders) are then sought from a selected range of general contractors (or in the public, sector openly advertised), who submit a lump sum price to carry out the work indicated in the drawings and specifications. A contract is signed and the work put in hand.
- *Construction Management* – There is a wide variety of methods for advancing the start of construction while at the same time introducing competition and assuming a reasonably firm price, before design is complete. These invariably involve an owner in retaining a construction manager who may be a construction company or a professional CM firm, during the design phase. There will then be a wide range of contractual alternatives for getting the work started.
- *Design-Build/Turn-key* – this is a very common approach that is used for relatively simple industrial facilities which involves negotiating or bidding from a statement of owner requirements which may be accompanied by very rough schematic designs, with a single company to take responsibility for both design and construction. Again there are many variations to this approach.

Other features of the industry which are important to understand are the size of the country, and hence most architects, engineers, and contractors still tend to operate regionally. Also, Bills of Quantities are not used in the US for building construction although Schedules of Quantities are used as the preferred method of bidding for civil engineering work.

Design professions: Larger practices are usually multi-disciplinary architects/engineers (usually structural, mechanical, and electrical), engineer/architects (usually civil, structural, mechanical, and electrical), and a wide variety of engineering design combinations. Some architects include interior design services, but there is a strong independent profession in this area. There is also a wide range of general management consultants for construction management, project management, cost consulting, scheduling control, etcetera. There is a legal requirement for construction documents to be sealed by registered architects. Registration is granted by state, not nationally. There are some reciprocity agreements between states, which makes multi-state licensure easier. Foreign architectural firms seeking work in the US will probably find it necessary to team with a local firm.

Contractors: The US construction industry is dominated by the general contractor. The general contracting approach is preferred by owners, rather than deal individually with separate trade contractors. This eliminates coordination problems and centralises liabilities. General contractors sub-contract much of the work on a project. Currently, overhead and profit markup for general contractors may be expected to be in the range of 10-15% of direct costs. Insurance and bonds may be 1-2% (of bid price) per year.

Governing codes and standards: Building codes are adopted by local governments. There are three major model codes that are the basis of many local codes. The model code organisations have formed the International Code Council to develop a single model building code for the US by the year 2000. On the East Coast two model codes are predominant: the Uniform Building Code is the basis for most codes in the northern East Coast States and the Southern Building Code is the basis for most codes in the southern east coast states. Non-government organisations develop material standards that are adopted by local authorities. The American Society of Testing and Materials (ASTM) is a major provider of material standards. Underwriters Laboratories also provides testing certifications for many materials.

Construction cost guides

Approximate construction costs: The following square foot unit rates are provided for rough comparison purposes.

	Alexandria, VA	Atlanta, GA	Boston, MA	Newark, NJ	Orlando, FL
Mid-rise office building					
Shell & core	750	645	700	915	825
Tenant fit-out	270	375	430	485	450
Industrial building with offices	500	485	540	650	460
Warehouse building	375	375	485	515	390
Above grade parking garage	270	215	215	290	220

East Coast US – Major architectural practices | design firms

This table was compiled with information supplied by the practices listed.

Architectural practice | design firm	Total architects	Total staff	Total offices	Area of Specialisation: Health care	Industrial	Commercial	Office buildings	Housing | Residential	Planning	Interiors	Sport | Leisure | Recreation	Hotel | Restaurant	Education	Laboratories | Research	Transport	Other
Arquitectonica	80	120	6	■	■	■	■	■	■	■	■	■	■	■		
Brennan Beer Gorman / Architects	33	140	3			■	■	■	■	■	■	■			■	■
Cesar Pelli and Associates	60	75	1	■		■	■	■	■	■	■	■	■	■	■	■
Chapman Griffin Lanier Sussenbach Architects, Inc.	18	19	1				■				■	■	■	■		■
Cooper Carry	115	140	2	■		■	■	■			■	■	■	■		■
Elkus / Manfredi Architects Ltd	95	105	1			■	■	■				■	■		■	■
Ellenzweig Associates, Inc.	45	60	1	■			■						■		■	
Ewing Cole Cherry Brott, Inc.	120	255	4	■			■	■			■		■	■		■
Ferris Architects	24	30	2			■	■				■		■			
Earl R. Flansburgh & Associates, Inc.	36	82	1				■						■			■
Fox & Fowle Architects, P.C.	45	55	2			■	■	■			■	■	■		■	■
Greenberg Farrow Architecture, Inc.	180	213	4			■	■	■			■	■				
Graham Gund Architects	19	43	1			■		■			■	■	■			
Harvard Jolly Clees Toppe Architects, P.A.,AIA	19	52	4	■			■						■	■		■
HLM	130	240	10	■			■					■		■		■
HLW International, LLP	200	260	8	■	■	■					■	■	■	■		■
JSA Inc. Architecture, Planning, Interior Design	37	5	1	■	■			■				■				
Kohn Pedersen Fox Associates PC	195	239	4	■		■	■					■	■		■	■
Machado and Silvetti Associates, Inc.	8	37	2				■	■					■			■
Richard Meier & Partners Architect	75	87	2				■	■						■		■
MMM Design Group	98	112	3		■										■	■
NFE Technologies, Inc.	45	50	5	■	■		■						■		■	■
O'Brien / Atkins Associates, PA	20	70	1		■		■				■		■			■
Pieper O'Brien Herr Architects Ltd	30	35	1		■	■	■	■					■	■		■
The Phillips Janson Group Architects, P.C.	140	179	5	■		■	■						■			■
Lee Harris Pomeroy Associates / Architects	25	30	1	■			■	■				■	■	■	■	
Prellwitz / Chilinski Associates, Inc.	23	26	1			■	■	■			■	■				
Michael Rosenfeld, Inc.	12	40	1			■	■	■			■		■			■
Rosser International, Inc.	59	250	4				■				■			■	■	■
Rothman Partners Incorporated	17	47	1	■									■	■		■
RTKL Associates Inc.	425	623	8	■		■	■	■			■	■	■	■	■	■
The Russell Partnership, Inc.	25	50	2	■			■	■			■	■	■		■	■
The S / L / A / M Collaborative	65	135	2	■			■							■		■
Sasaki Associates, Inc.	203	348	2				■				■		■			■
Shepley Bulfinch Richardson and Abbott	160	220	1	■		■			■	■			■	■		■
Skidmore, Owings and Merrill LLP	350	700	6	■			■	■			■		■		■	■
Spector Group	38	69	4	■		■	■					■	■			■
Robert A.M. Stern Architects	26	109	1	■		■		■			■	■	■			■
Symmes Maini & McKee Associates	35	200	2		■	■	■						■	■		■
Thompson, Ventulett, Stainback & Associates, Inc.	100	164	2			■	■				■	■	■			■
TRO / The Ritchie Organisation	60	175	3	■				■								
Wallace, Floyd Associates Inc.	23	68	1				■						■		■	■
WTW Architects	40	66	2	■	■	■	■	■			■	■	■	■		■

Brennan Beer Gorman / Architects

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Head office
515 Madison Avenue
New York, NY 10022
USA
Tel: +212 888 7663
Fax: +212 935 3868
e-mail: bbg@bbga.com

Offices
13/F Lyndhurst Tower
1 Lyndhurst Terrace
Central, Hong Kong
Tel: +852 2525 9766
Fax: +852 2525 9850

1250 24th Street, NW
Ste. 250
Washington, DC 20037
USA
Tel: +202 452 1644
Fax: +202 452 1647

Partners
Henry Brennan, AIA
David Beer, FAIA
Peter Gorman, AIA
Mark Boekenheide, AIA, ASID
Ted Brumleve, AIA
Hugo Consuegra, RA
John Dieken, AIA
Sergio Gonzalez, RA
Marc Gross, RA
Louis Hedgecock, AIA
Mario LaGuardia, AIA
Yann Leroy, DPLG
Frank LaSusa, AIA
Julia Monk, AIA, ASID
Jeffrey Williams, AIA

Practice profile
Founding partners, Henry Brennan, David Beer and Peter Gorman, set up their New York-based practice in 1984, following an earlier collaboration of more than 20 years. Building on their established expertise in the design of new office buildings, hotels and retail centres around the world, the firm provides outstanding client service, with integrity and full accountability to each clients' programme and budgetary requirements.

Pushing the design expression toward new horizons are the more than 140 talented architects and designers who manage the firm's global practice.

Area of specialisation
The firm is recognised for its design expertise in a variety of building types frequently found as the major components in large-scale, urban mixed-use projects: hotels, conference centres, retail/entertainment, commercial office buildings, transportation centres, and related support facilities. Brennan Beer Gorman / Architects is known for it's skillful planning, design creativity and commitment to project team leadership – key qualities required to drive each project from concept into a vital and embracing environment. The firm has created unique structures for the following project types worldwide:

Mixed-use developments
Commercial office buildings
Hotels, resorts & casinos
Retail & restaurants
Conference centres
Spas and health clubs
Entertainment Complexes
Urban residential developments

Projects underway in

Brazil	Mexico
Egypt	Thailand
Hong Kong	People's Republic of China
Indonesia	The Philippines
Malaysia	USA
	Vietnam

2

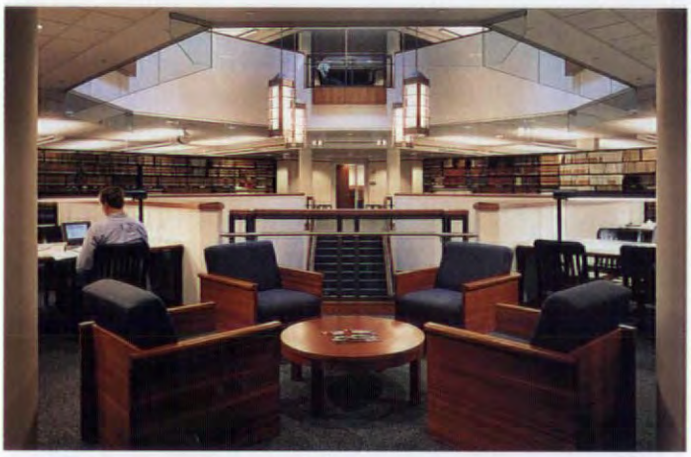
3

1: Jakarta Stock Exchange Building, Indonesia

2: The Peninsula Bangkok, Thailand (opening Spring 1998)

3: Jiwasraya Tower, Jakarta, Indonesia

Earl R Flansburgh + Associates, Inc



Head office

Earl R Flansburgh + Associates, Inc
77 North Washington Street
Boston, Massachusetts 02114 USA
Tel: +617 3673970
Fax: +617 7207873
e-mail: kbrannelly@erfa.com

Size of firm

75 Employees

Key personnel

Principals

Earl R Flansburgh, FAIA, NA
President
David S Soleau, AIA, Executive Vice President
Michael H Bourque, FIIDA, Senior Vice President
Kate M Brannelly, SMPS, Vice President / Director of Marketing

Senior Associates

David A Croteau, AIA
Duncan P McClelland, AIA
Alan S Ross, AIA

Associates

Edward E Calamari, AIA
John P Campbell, AIA
Stephen A Casentini, AIA
Jorge M Cruz, AIA
Marie E Fitzgerald, IFMA
Jeanne A Kuespert, AIA
Peter W Lambert
Douglas P Murray, AIA
Christopher A Sgarzi, AIA
Louminda R Torbett, IIDA

1: Exterior of main entrance of Boston College Law School, Law Library, Newton, Massachusetts 84,500 gross square feet, 348,000 volumes

2: Interior of Boston College Law School, Law Library, showing carrel seating

3: Interior of interactive lecture hall in conference centre. Cabot Corporation, Administrative Offices / Training Facility, Billerica, Massachusetts 60,000 gross square feet office building, offices and conference centre

4: Exterior of main entrance to South Lawrence East School, Lawrence, Massachusetts 215,000 square foot, Pre-K-8 public school for 1,480 students

Company profile

Earl R Flansburgh + Associates, Inc provides comprehensive design services in architecture, master planning and interior design to a broad clientele in business, industry and education. For over three decades, we have refined a project approach that integrates a collaborative design process with the production of high quality contract documents to meet diverse clients' programme requirements with budget and schedule constraints. The interface of disciplines occurs during all phases of our design process, so the result is comprehensive and unified. Our approach enables us to provide an overall standard of excellence in both interior and exterior building design.

The long-standing leadership of our principals, the continued dedication and professionalism of our design staff, and innovative designs have gained us a national reputation for design excellence, cost control and outstanding service which has been recognised by numerous design awards and publication of our work in design and client magazines, journals and books.

Services

Architecture
Master planning
Educational programming
Space planning
Interior design

Expertise / Specialisation

K-12 School planning & design
Facilities & campus master planning
Corporate office planning & design
Renovation / adaptive reuse

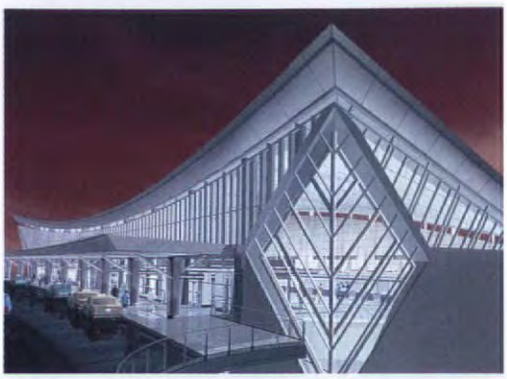
Recent clients

Advantage Schools
Boston College
Brown-RISD Hillel Foundation
Cabot Corporation
Donaldson Lufkin & Jenrette
Fidelity Management Research Corporation
Fleet Bank
John Hancock Mutual Life Insurance
Life Care Services Corporation
Maimonides School
Moses Brown School
Reebok International, Ltd.
Ropes & Gray
Steelcase, Inc.
Thayer Academy

Major past projects

Boston College Law School Master Plan & Design
Cabot Corporation Corporate Headquarters
Edgewood Life Care Community
Fidelity Investments Headquarters Renovation
City of Malden, Massachusetts, New K-8 School Building Program
University of North British Columbia-Prince George Campus Facilities Master Plan
Ropes & Gray Law Offices
Worcester Polytechnic Institute, Founders Hall

Kohn Pedersen Fox Associates PC



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Head office
111 West 57th Street
New York
NY 10019
USA
Tel: + 212 977 6500
Fax: + 212 956 2526

Firm description

Founded in 1976, Kohn Pederson Fox (KPF) offers full architecture, master planning, space planning, programming and building analysis services. The firm's work in the US and abroad has earned KPF recognition as one of the most respected architectural design firms in the world. Now, with offices in New York, London and Tokyo and an increasing number of projects in foreign countries, including Australia, China, Cyprus, Hong Kong, Indonesia, Japan, Korea, Malaysia, New Zealand, the Philippines, Singapore, Taiwan, Thailand, Vietnam, Argentina, Canada, Chile, Spain, France, Germany, Mexico, the Netherlands, Belgium, Israel, Turkey, and the UK, the firm's international reputation is growing. KPF is 126 people strong in the New York office with 70 employees in the London office.

Approach to design

The philosophy of KPF begins with an insistence on design excellence, partner commitment and superior management. The partners, together with a team of architects, are involved in the supervision and design of each project from the initial stages of planning through construction and post-occupancy. This unique approach ensures that each project is monitored daily so that it can proceed smoothly and efficiently. KPF considers each client to be an equal participant in the design process. A number of alternatives for each commission are presented to the client and then the advantages and disadvantages of the different schematic layouts and design sketches are discussed. At every stage, design recommendations are submitted to the client, to achieve established design and budget requirements. This curtails the redesign of projects which can be both costly and time-consuming. KPF is attentive to the client/user's special needs and interests as well as the site and region of each project. The majority of the firm's clients have commissioned KPF for more than one project.

Awards and recognition

KPF's commitment to teamwork and quality coupled with strict attention to detail and design has earned the firm respect and an outstanding reputation with clients and colleagues, as well as the press.

In 1984, 333 Wacker Drive received the American Institute of Architects Honor Award; Procter & Gamble received the same prize in 1986. DG Bank, a 85,000 square metre complex including offices, apartments, retail and underground parking space in Frankfurt, Germany was the recipient of several awards, the prestigious PA Award, the New York Chapter, New York State, and the National AIA Design Awards.

The Rockefeller Plaza West project, a 1,200,000 gross square foot office building in New York, was awarded the same PA Award in 1989. In 1990, KPF received the Architectural Firm Award. An award that is given in recognition of years of achievement and contribution to the built environment, the Architectural Firm Award is the highest honour granted to an architectural firm by the American Institute of Architects. KPF has also designed such notable projects such as 1250 Boulevard Rene-Levesque, a commissioned project by Marathon Realty & IBM Canada, Limited for their Corporate Quebec Headquarters in Montreal which won several AIA Awards for Design Excellence in New York and Quebec; and the World Bank, an 830,000 square foot complex consisting of general and executive offices, gallery corridors, cafeteria, auditorium, conference facilities, lobby and lounge areas which was won through an international design competition of over 100 entrants.

In 1994, the US Courthouse in Portland was awarded by the General Services Administration (GSA) the Building Design Excellence Award and in 1996 the Federal Courthouses at Minneapolis, MN and Foley Square, NY won GSA Design Awards. The Independence Square project in Washington DC won the Presidential Design Award for Federal Design Achievement. In 1995, the Shanghai World Financial Center and Greater Buffalo International Airport projects were awarded a NY City Chapter AIA Design Award. In 1996, the Samsung Rodin Museum in Seoul, Korea won both a PA Award and the NY Chapter AIA Award for Design Excellence.

1: Buffalo International Airport, US

2: Samsung Rodin Museum, Seoul, South Korea

3: The World Bank, Washington DC, US

4: Shanghai World Financial Center, Shanghai, China

Shepley Bulfinch Richardson and Abbott

Architecture • Planning • Interior Design

Jeff Goldberg/Esto

1

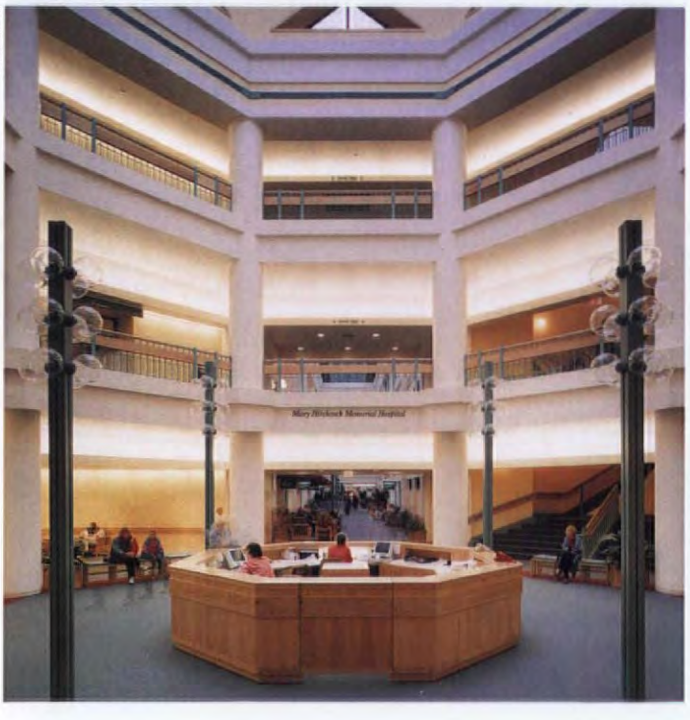
Richard Mandelkorn

2

Timothy Hursley

3

Jean M Smith



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Office

40 Broad Street
Boston, MA 02109
Tel: +617 423 1700
Fax: +617 451 2420
email: mfurlong@sbra.com

Key personnel

W. Mason Smith III, AIA, President
Geoffrey T. Freeman, ALA, Principal
H. Jan Heespelink, AIA, Principal
Alexander Howe, AIA, Principal

Recent projects and clients

- Rhode Island Hospital, Hasbro Children's Hospital
- Case Western Reserve University, Kent Hale Smith Engineering and Science Building
- Boston Public Library, McKim Building Restoration and Renovation
- Fidelity Properties, Fidelity Investments Regional Campus
- Fordham University, New University Library
- Babies and Children's Hospital of New York at Columbia Presbyterian Medical Center, New Bed Tower
- General Services Administration, The Warren B. Rudman US. Courthouse
- University of Miami, School of Law Library Addition
- City of Cincinnati Main Public Library Expansion
- Yale University, Sterling Memorial Library Renovations and New Music Library

1: Albin O Kuhn Library and Gallery University of Maryland, Baltimore, Maryland

2: Deaconess Hospital, New Clinical Building Boston, Massachusetts

3: The Leavey Library University of Southern California, Los Angeles, California

4: Dartmouth Hitchcock Medical Center Lebanon, New Hampshire

Firm profile

Shepley Bulfinch Richardson and Abbott, (SBRA), one of the oldest continuously practising firms in the country, has an extraordinary legacy of providing clients with architectural excellence. Its practice is distinguished by depth and diversity, with particular expertise in the planning and design of public and private libraries, academic buildings, medical facilities, and corporate structures.

Team approach

SBRA's award-winning architecture and project success are due to the firm's uncompromising commitment to client needs. Our projects demonstrate our belief that a superior architectural product is the artful combination of client vision and SBRA talent. We are deeply involved in the collaborative process, providing thoughtful service and creative solutions that respect project scope, budget ant scheduling restrictions. Recently named one of the best managed firms in the US by the American Institute of Architects, SBRA experience is built on successfully anticipating and adapting to change and skillful client communication. Our design strengths are enhanced by a team approach that allows for a thorough review and discussion with all key project participants to ensure client satisfaction.

Design philosophy

SBRA is dedicated to a design philosophy that is expressed in aesthetically dynamic and functionally superior architecture. Every project is managed by a principal who is a proven team leader and design advocate with the firm, ensuring consistency and continuity over the life of the project. In addition, in-house design reviews bring an interdisciplinary scrutiny to programme needs and details, providing a level of quality control that is unmatched in the industry. All design professionals are abreast of the latest materials and technologies so that exciting design is delivered economically, and the building project becomes a lasting contribution to its community.

Comprehensive design services

Our design philosophy and project management expertise are further complemented by our Interior Design Group, skilled in a variety of interior expressions. Our interiors professionals are experienced in translating architectural design features into comfortable, people-friendly environments and designing spaces that reflect the character and personality of our clients.

We offer our clients the exceptional value of designing architecturally significant buildings through a process carefully managed by experienced, forward-thinking design professionals.

New patient care tower for St. Francis Hospital Center, Hartford, Connecticut includes acute care and ambulatory services. (Photo: Scott McDonald, Hedrich-Blessing Photography)

Philippines Medical Center will incorporate the full range of diagnostic treatment and research facilities in a 1.2 million s.f. medical complex.

Cullman Regional Mecical Center in Alabama integrates a new 115-bed hospital, ambulatory care center and medical office building on a 73-acre site. (Photo: Timothy Hursley)

TRO/THE RITCHIE ORGANIZATION

Head office
80 Bridge Street
Newton, MA 02158, USA
Tel: +617 969 9400
Fax: +617 527 6753
e-mail: troarch.com

Key personnel
Wendell R Morgan Jr, AIA – Chief Executive Officer
Robert Hoye, AIA – President
Susan Daylor, FMP – Vice President, Marketing

Branch offices:
115 21st Street North
Birmingham, Alabama 35203, USA
Tel: +205 324 6744
Fax: +205 521 0591

Key Personnel
Joseph L Bynum, AIA – Vice President
Patrick B Davis, AIA – Vice President, Marketing

3050 Bee Ridge Road
Sarasota, Florida 34239, USA
Tel: +941 923 4911
Fax: +941 922 7940

Key Personnel
Fred C Frederick, AIA – Vice President
Dennis LaGatta, AIA – Vice President, Marketing

Practice profile
Established in 1909, The Ritchie Organization is a 170-person planning and design firm specialising exclusively in health-related facilities. Currently TRO is ranked among the top 12 US healthcare facilities design firms (*Modern Healthcare* magazine April 1996). Our award-winning project experience ranges from the design of new, large scale "medical cities" – incorporating hospitals, ambulatory clinics, biomedical research laboratories, conference facilities and residences – to ambulatory care clinics and renovations of patient care floors. TRO has worked for over 400 clients around the world with construction volume totalling more than US$3.5 billion. Projects are currently underway in the USA, Europe, the Middle East and the Pacific Rim.

Outstanding client service, coupled with a fundamental understanding of the ever-evolving demands of the healthcare delivery system are at the forefront of TRO's business philosophy. We work with our clients to define a standard of excellence that responds to their needs, with flexibility, imagination and the highest quality design services. The firm's record of repeat business is over 90 percent. Client relationships have spanned decades, some of them over 40 continuous years, attesting to our clients' utmost satisfaction with our performance.

Services provided
Architecture
Interior design
Space planning & programming
Real estate asset consulting
Site & facilities master planning
Project/construction cost evaluation
Mechanical/electrical/plumbing and fire protection engineering

1: The Georgia International Plaza/Georgia World Congress Center, Atlanta, GA, US

2: The Plaza at King of Prussia, King of Prussia, PA, US

3: United Parcel Services, World Headquarters, Atlanta, GA, US

4: Hyatt Regency Aruba, Resort Hotel and Casino, Aruba, Dutch West Indies

1

Thompson, Ventulett, Stainback

2

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4

Corporate office
Thompson, Ventulett, Stainback
2700 Promenade Two
1230 Peachtree Street, NE
Atlanta, Georgia 30309
Tel: 404/888 6600
Fax: 404/888 6700
email: hhatch@tvsa.com

Key personnel
H Preston Crum, AIA
Michael H Ezell, AIA
Ray C Hoover, III, FAIA
C Andrew McLean, FAIA
Roger L Neuenschwander, AIA
J Thomas Porter, AIA
Thomas W Ventulett, III, FAIA

Size of firm: 170 employees

Representative projects
Provided through its architects and affiliates: Hyatt Regency, Aruba; McCormick Place Expansion, Chicago; Pennsylvania Convention Center, Philadelphia; Orange County Convention Center, Orlando; Long Beach Convention Center, Long Beach; Salt Palace Convention Center, Salt Lake City; Georgia Dome, Atlanta; Georgia World Congress Center and International Plaza, Atlanta; Prince Street Corporate Headquarters and Manufacturing Facility, Cartersville, GA; UPS Headquarters, Atlanta; King of Prussia Mall Expansion and Renovation, King of Prussia, PA; Phipps Plaza Expansion and Renovation, Atlanta; Northland Mall, Melbourne, Australia; Jawad Commercial Complex, Bahrain; Dadeland Mall, Miami, FL; Plaza Vespucio, Santiago, Chile

Furture projects
Mall of Georgia, Atlanta; Dulles Town Center, Loudoun County, Fairfax,VA; Palm Beach Convention Center; Washington, DC Convention Center; Milwaukee Convention Center; McCormick Place Hyatt, Chicago; HBO Company Offices, Atlanta

Recent clients
Aseger, SA
AT&T
Compass Retail
CARTER
The Coca-Cola Company
Corporate Properties Investors
Cousins Properties Incorporated
Doubletree Hotels
Simon - DeBartolo
Delta Air Lines
First Union National Bank
GTE Data Services
Gulf Power Company
Hines
Hyatt Hotels
IBM Corporation
Kravco
Lend Lease Corporation
Life of Georgia
Omni International Hotels
United Parcel Services
The Gandel Group of Companies
Yarmouth Group

Services
Architecture, Interior Design, Planning, Facilities Management, Urban Design, Graphics

Company profile
Thompson, Ventulett, Stainback and its associates (TVS) are dedicated to and engaged in the creation of distinguished designs through responsive, comprehensive and personal service to clients. The firm strives to combine philosophical objectives with economic and functional considerations to create environments of lasting value.

Founded in 1968, TVS is an internationally recognised 170-person organisation with projects in over 25 states and a number of foreign countries. The firm's portfolio showcases a wide array of project types including convention and trade centres, hotels and resorts, retail centres, commercial and industrial facilities, corporate headquarters, office buildings, performing arts facilities, and sports arenas. Interior design is also an important part of TVS's practice, as is master planning, urban design, and facilities management.

Organised around design studios that guide each project from its inception to completion, TVS manages a creative process that carefully balances the needs of design, technology, and business in a diligent quest for excellence. TVS's reputation for design quality has been recognised by their receipt of over 130 national and local design awards for planning, architecture and interior design excellence.

TVS has developed a portfolio displaying varied architectural designs which draw inspiration from the contextual demands of the site and the human criteria required by the building. Numerous important convention centres have been designed by the firm. Each centre has a unique character which is appropriate and responsive to the site, and contributes to the city fabric in which it is located. Some of the most successful developers have entrusted TVS with the design of their commercial developments. Working in collaboration with their clients, TVS architects, planners, and interior designers address the clients' goals and needs within the cultural and economic marketplace resulting in successful and appropriate design.

Face to face

Disney's silly business

As president of Walt Disney Imagineering, Kenneth Wong is responsible for the development and management of all Disney real estate, and for the company's creative design and research. He was promoted to president in May 1996 when the Disney Development Company and the Imagineering unit were merged. Wong heads Disney's efforts in developing theme parks, hotels and resorts, retail stores and entertainment facilities, but in conversation with Joseph Giovannini, he denies that Disney "cultivates" real estate. Building is simply a means to an end – a way of supporting the growth of other areas of Disney business – particularly on the East Coast of the US. Only the best architects are employed for the job, from Arquitectonica in Florida, to Hardy Holzman Pfeiffer in New York, and the emphasis in any brief, he explains, is on delight.

At the April opening of Disney's New Amsterdam Theater on 42nd Street in New York, (see building review in the Special Report) Michael Eisner downplayed the conglomerate's role as its developer: "We're a silly company, not a serious company." Despite millions of square feet built on the East Coast over the last dozen years, the president of Walt Disney Imagineering, Kenneth Wong, confirms his boss's observation that the Disney Company does not really cultivate real estate. "The mission of our development practice is to support the growth of our core business on 42nd Street, the building was a vehicle for our theatrical development" he says. "If, according to Vitruvius, architecture is a matter of firmness, commodity and delight, our emphasis is decidedly on delight." He explains that while the company builds its own offices, it doesn't go out and build speculative offices: "We don't add value if we're just building an anonymous box to house a business function."

Until a year ago, there were two development arms of this non-developer. Formed in 1952, the Imagineers worked inside the gates of the theme parks – creating the rides, theming the buildings – and the Disney Development Corporation, formed in 1984, did the work outside the gate – hotel resorts, office buildings, casting centres. Speaking on the first anniversary of the consolidation of the Imagineers and Disney Development into one division, Wong explains that the sector of the company's portfolio most closely related to its silly business is the theme park and resorts enterprise. "When it comes to creating buildings and places outside theme parks, I would say our mission is to complement, in a way consistent with the Disney brand, what we call the 'guest experience'. That includes building for our own company – we think about our employees, or our 'cast' as we call them, as guests in the building." Wong estimates that the combined development asset base – the theme parks and resorts – amounts to about 25 percent of gross revenue of the company.

For all its profile on the East Coast, the Disney empire is highly focused in only two places – Manhattan and Orlando, Florida. Almost all the buildings since 1984 – by such ranking architects as Michael Graves, Robert Stern, Arata Isozaki, Robert Venturi and Aldo Rossi – are located in Orlando, fused to Disneyworld in a development of huge critical mass. "For us the East Coast, first and foremost, means Orlando. We have plenty to keep us busy there for years to come." Disney's more recent additions include the town of Celebration and the Disney Wide World of Sports Complex, by Washington D.C. architect David Schwarz. The company has retained Arquitectonica as design architect for one of its themed hotel resorts, the All Star Resorts (see building review in this report). "If there's a Disney entertainment business that has a place-making or real estate need, we facilitate creating a great home for the unit," says Wong.

In the case of Hardy Holzman Pfeiffer's New Amsterdam, for

"If, according to Vitruvius, architecture is a matter of firmness, commodity and delight, our emphasis is decidedly on delight"

"The combined development asset base – the theme parks and resorts – amounts to about 25 percent of gross revenue"

example: "The effort was to create a permanent home for theatrical productions. It was a design created for a statement that one of our businesses wants to make", not a real estate development. Disney's other major venture in New York is its high-profile Fifth Avenue store. "We help when there's a very large store in a one-of-a-kind location," he says. "The Manhattan store is full of allusions to New York history and show business, within an old brownstone environment that holds a Disney treasure trove." Imagineering only becomes involved in signature projects, and has developed the outlets in Los Angeles, Chicago and San Francisco as well as New York. Wong's division has not participated in establishing some 500 stores that now exist across the United States. "It is probably fair to say that in our theme parks, we have proprietary knowledge, talent, technological expertise, and a design legacy – a lot of the content comes out of the Walt Disney company. And that work is primarily produced in-house," says Wong. "For most of the work that doesn't involve primary company software, which is more often the case in a corporate office building or a hotel, we'll continue to engage leading outside architects." With some exceptions, the company holds invited competitions, limited to three to five participants, both for master planning concepts and for preliminary architectural direction.

What does Disney look for in an architect? "The words may sound trite, but they do mean something ultimately: originality, creativity, inventiveness," he says. "We try and find the kind of natural resonance between the nature and purpose of the facility, the spirit of the people who will occupy it, and the work of the candidate architects. I'm not sure we're any more scientific in the process than anybody else, but we do try and think about the basic values in the attitude and ethos of an architect's oeuvre." He cites the example of the ice skating rink designed by Frank Gehry in Anaheim. "We wanted something that was soaring and inspirational, but at the same time organic and humble," he recalls. "We didn't want a palace to athletics; we wanted something that would have more than an industrial quality but would still exhibit a certain raw honesty. We felt Gehry's work in some way combined those kinds of values." The East Coast for Disney means more than a regional business opportunity with national and international draw. "From Miami to Boston that corridor represents a hot-bed of design talent – I can't imagine that it won't always be a very powerful axis for design, planning and development that will figure prominently in the way we think about our enterprise."

And just what role has Disney played in the emergence of "entertainment retail" that has become a development force in the United States? "Some people point to the Disney stores of the mid-eighties as the beginning of theatrics in the retailing experience, whether it was the design, props, the merchandising itself – or just the fact that the cast members in the stores welcomed customers in a more theatrical and personal way. Ten years ago we were all reading about the demise of the department store and the rise of catalogue – and then Internet – shopping, and one response was to enhance the experience outside the house, whether it was movie theatres or stores that became more of an event. That is, shopping and browsing would be done in a social, more experiential way. I don't know if entertainment retail is a big force, but there certainly is momentum now, and I would agree that retail streets are more theatrical and entertaining today than ten years ago."

"It's part of the larger question about how you make an out-of-home experience something you want to repeat. In development yes, entertainment retail has changed the way people are planning stores and laying out large-scale shopping centres and resorts to create a shared experience. The emphasis on the social and experiential aspect of retailing makes it more than simply a design trend. I guess it's just a matter of coming back to delight."

New buildings on the East Coast of the US

A modern face for classical Virginia

A handsome new addition to a long-established precinct of state government buildings, anchored two blocks away by Thomas Jefferson's 1785 State Capitol, in Richmond, the Library of Virginia by Skidmore, Owings & Merrill (SOM) presents a strictly modern interpretation of classical forms. Vernon Mays visits the site of the Library and talks to the client, library director Nolan T Yelich, and the architect, Craig W Hartman, design principal of the San Francisco office of SOM. Photography by Prakash Patel.

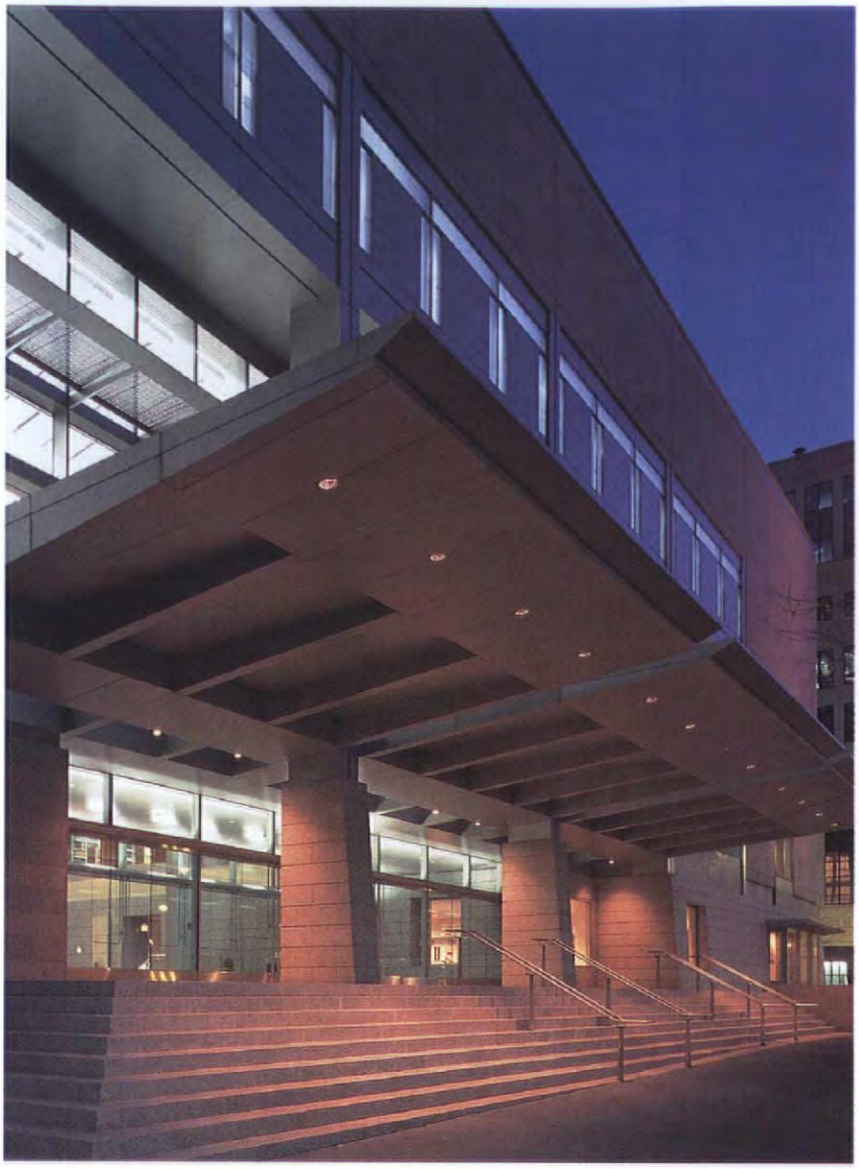
The client's account

Three primary issues were the driving forces in design of the library. First and foremost, we were concerned about the environmental conditions in a building for the collections. There must be humidity under 50 percent and, ideally, temperature under 70 degrees fahrenheit. We couldn't control that in our former building. But our archives are invaluable, dating back to 1607 at Jamestown. We have 84 million items in the archives, and much of it had to be stored in off-site locations until we moved into this building.

The second factor driving the design was that the paradigm was changing in terms of technology. We wanted to face up to the challenge. In our former building, we didn't have the kind of infrastructure that could support emerging technologies and what we needed to be able to do as an information provider. Our new capabilities include being able to load our collections into databases, having access to the Internet, and access to other full-text databases from the private sector. We have a fibre optic backbone and an ATM backbone. We designed an electrified grid on a number of floors, where we

1

1: The library is traditional in massing, but overtly modern in expression



have access to voice, data, and video on a four-foot-square grid. So whatever we decide to do in terms of public service configurations or staff alignment, we always have that technology at our fingertips.

Third, the collection here is known by scholars around the world. We are to Virginia what the National Archives and the Library of Congress are to the federal government in Washington. That calls for special attention, because we are a very special institution. Because of our mission, we felt that we needed to create a building that was not only appropriately monumental, but one that would be a broad-based, multicultural institution that goes beyond what you traditionally find in a research institution housing manuscripts, archives, books and serials. This building breaks the mould in terms of what a libraries and archives are all about.

Our challenge was to create an institution that was non-threatening and comfortable for people of every generation. But we couldn't compromise certain things that are essential to the integrity of the programme and the collection. So we've got very sophisticated security built into the building. We still have closed collections, but by creating monumental reading rooms on the second floor we are able to free up the collections for easy access. We had 10,000 volumes open to the public in the old building. We have the capacity for 75,000 volumes here. The rest of the collection is still in closed stacks. But when you come in, there is no doubt you are in a library.

From an urban design perspective, the city of Richmond provided the site to help with the revitalisation of Broad Street, a major corridor through the city that was once the heart of retail activity. For me, the design was a question of how you take an essentially introverted building type and make it animated. That's one reason we wanted to make the reading rooms as open as possible – like a beacon. We really wanted to be a partner in the redevelopment of the urban corridor in downtown Richmond, which is in transition from a retail corridor into a centre for culture, entertainment, and government.

And the outcomes have exceeded our expectations. We felt confident that the time we put into feasibility, programme development, and design would yield dividends. But you never know until you open the door. Since we opened on the third of January this year through to the end of April, we have had over 60,000 visitors, which exceeds our all-time high for an entire year in the old building. And we know that people are coming for purposes beyond mere curiosity seeking. Basically, every day the breakout rooms, auditorium, orientation room, and computer training room are booked solid. And we want to encourage that. That's why this building was designed.

Our usage is way up – not only inside the building, but because of our presence on the World Wide Web. Last year 55 countries visited our site on the Internet. And I think that's because of the massive digitisation that we have accomplished over the past couple of years. In fact, we have digitised over three million images. And it really opens up our collection, because of the electronic infrastructure we have.

2: The wing-like form of the entry canopy is constructed of built-up T-sections and tapered structural members

3: Squares of limestone form a tight skin on the upper facade, punctuated with grey aluminium panels, perforated steel sunscreens and glass

›

1

The architect's account

The architect of a major civic building is under a special obligation to provide an enduring design. The goal is a building that will be sufficiently cherished over long intervals to warrant renewal and further useful life. It needs to be inherently functional, first of all, and also part of the very fabric of the place.

In selecting a site for The Library of Virginia, the state considered the possibility of suburban locations, but the library's staff and building committee were dedicated to an urban setting. They saw it as a work of civic architecture that needed to be near the State Capitol, as it had always been. They also felt it could be a catalyst for reviving downtown Richmond.

Earlier studies had suggested a taller building, but this seemed inappropriate to its civic nature. Its height and massing are traditional for public buildings in Richmond, as is its limestone cladding. The granite plinth at its base relates it to the Old City Hall nearby.

The library's strong entry on Broad Street anchors an important street that was once the city centre for shopping and theatre-going. To animate the street as much as possible, we made the public life of the building part of the life of the street. The bookstore, auditorium, and conference centre have street frontage, while the double-height reading rooms at the *piano nobile* overlook this important corridor. The library is part of city life, visually connected to passersby along the street.

Because of Thomas Jefferson, we think of Virginia architecture as classical and Palladian. Yet Jefferson's own work plays inventively with this tradition. I tried to do the same with the new library. Its symmetrical organisation, anchored corners, and opening at the centre of each facade refer to classicism. Yet the design also breaks this down. The base, for example, is fractured by elements – such as the conference room and the display vitrines – that reach out to the street. The limestone cladding is expressed as a thin veil stretched taut over the steel frame, so that the real structure "reads".

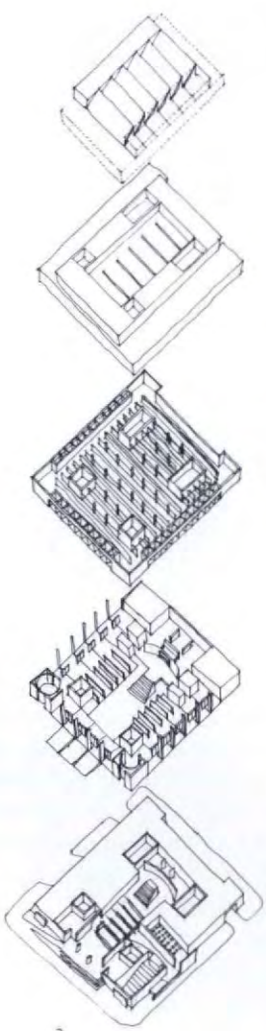
The library is organised in a very clear way so that patrons intuitively find their way around. In plan, it wraps around a public room that extends the realm of the street to the heart of the building. The materials of this large volume reflect those of the building's street frontage – the same granite paving, for example. You enter the building compressed under the "bridge" of the reading room above and then find yourself in the expansive lobby – a public square or courtyard, as some have called it. Within this public space you are immediately aware of books. The open stacks overlook the room to left and right, while the library's archive of rare books and manuscripts hovers above the grand staircase that leads up to the second floor.

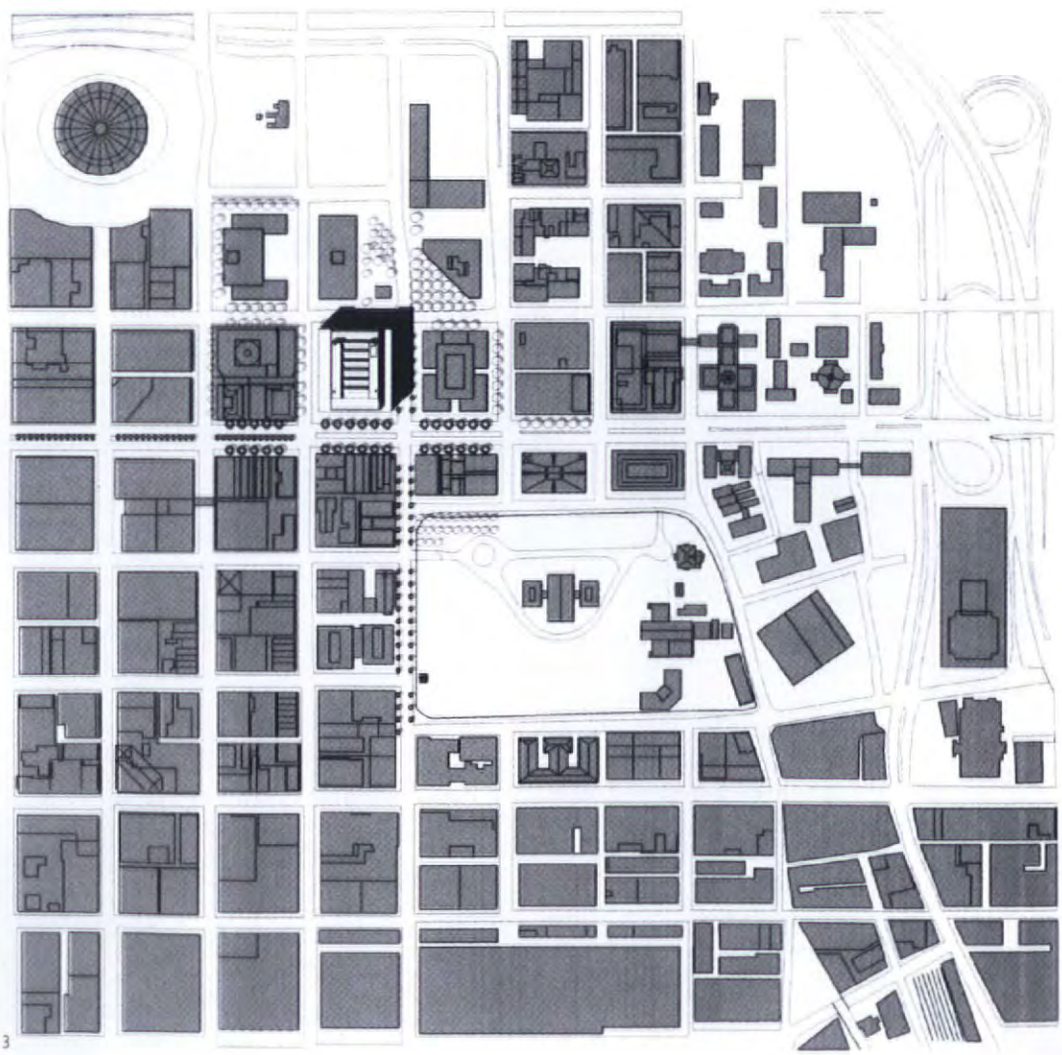
Technology is integral to this world, and therefore integral to the building and designed to be as accessible as possible. Every space is prewired for power and data transmission, giving it ›

1: Light-filled double-height reading rooms ring the perimeter of the building on the piano nobile, and have views over the city

2: Horizontal layering concept sketch. The rigorous separation of uses floor by floor infuses the building with a logic that is easy to understand

3: Site plan showing the library only two blocks away from the State Capitol in the city centre





1: The two-storey-high lobby with cherry bookcases in the upper wings

2: Detail of east elevation

3: East elevation

› remarkable flexibility. The reading room tables, which we designed, provide hookups for notebook computers and incorporate task lighting appropriate to reading books and working with the computer. Terminals are also provided, so that all patrons can order books directly from the closed stacks.

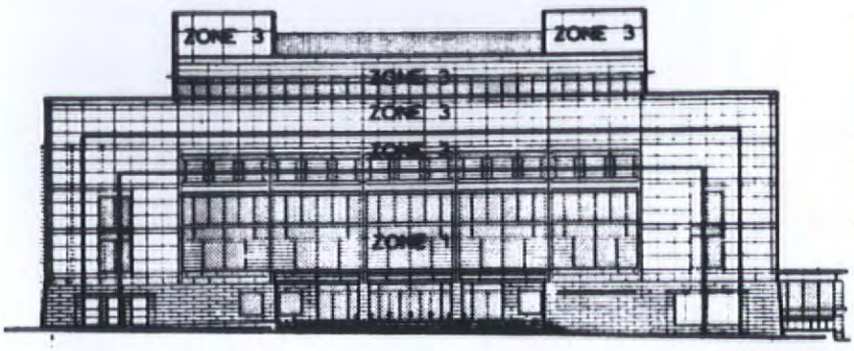
In an era of truly monumental public library construction budgets, The Library of Virginia is one of the great bargains. It was built for less than US$80 per square foot. This compares to US$217 to US$230 per square foot for the new main libraries of San Francisco and Los Angeles. While some of the cost savings are attributable to the depressed conditions of the local economy at the time of its construction, it also reflects a straightforward design. At the heart of this is the building's very simple structural grid, which provides its dominant ordering system. By approaching this honestly, in the modern tradition, we were able to develop a civic building of classical presence and proportions.

Appraisal

Tradition remains such a strong cultural influence in Virginia that some say the modern movement bypassed the state altogether. That position may seem a bit extreme, but the point is well taken: traditions, architectural and otherwise, are not to be taken lightly here.

The prevailing traditions, of course, are Anglo-Saxon, tracing back nearly four centuries to the first British colonists at Jamestown and, indeed, further back when one considers the strong cultural ties between early Tidewater society and the mother country. So it is no stretch of reason that a British model found its way subtly woven into fabric of The Library of Virginia, the new 438,000-square-foot state library and archives building in the capital city of Richmond.

Architect Craig Hartman of SOM's office in San Francisco is quick to point out the classical antecedents of his Virginia library. His inspiration: Sir Christopher Wren's library in Dublin, where visitors enter a nave-like space and immediately feel the presence of books in stacks that run soldier-like along both sides of a centre aisle. Hartman's scheme for the Virginia library follows a similar parti, with visitors entering a commodious two-storey-high lobby adorned by elegant cherry bookcases clearly visible in the upper wings. But, like almost everything about this building, his design for the spacious lobby is grounded firmly in the sensitivities of the modern era. The solution is both a symbolic stroke of genius by the architect and a public relations coup for the library, which is striving to shake off its image as a stuffy warehouse for government records, seeking instead to position itself as a democratic institution for the study of Virginia's historical treasures.



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The desire for an open and accessible building influenced everything from the design of the front steps, which splay out from the entrance to welcome visitors, to the fundamental character of the facade, which has generous glazed openings to reveal the activity inside. SOM studied a variety of massing alternatives, some as tall as nine storeys. But the outcome revealed costs would be better contained by making the library shorter and spread out. More importantly, the library's status as a public institution begged for a massing associated more with civic buildings than with office towers. Beginning with the premise that the base of the building would be clearly manifest, Hartman created a granite-sheathed plinth with a minimum of punched openings. Within that base he inserted a wide variety of public functions that distinguish this research library from most of its counterparts. They include a conference centre, bookstore, training rooms, 1,200-square-foot exhibit gallery, orientation room, and 256-seat auditorium. Restricting these messy activities to a single floor also accommodated the stringent security demands of the archival collection, which is located on upper floors behind locked doors.

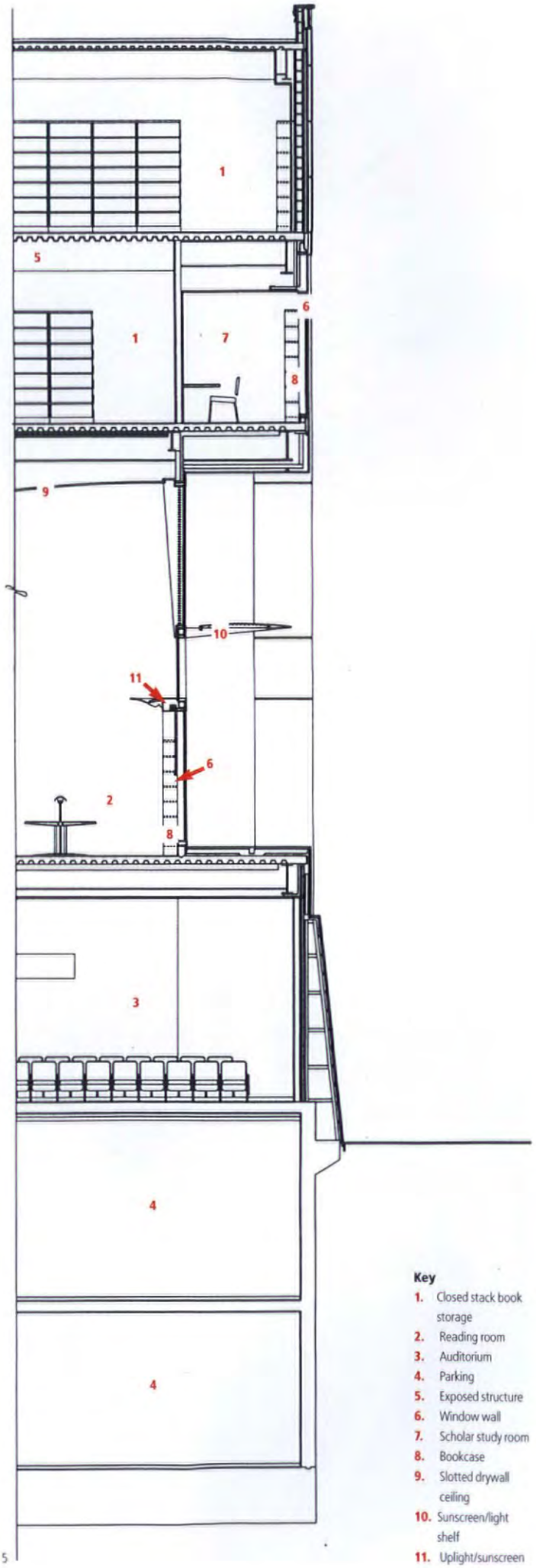
The rigorous separation of uses floor by floor infuses the building with a logic that makes it easy to use and understand. From the lobby, visitors ascend a monumental stair to the second-floor reading room level. Light-filled reading rooms ring the perimeter of the building, offering views of the city to library patrons. Two floors of closed stacks containing 55 miles of fixed metal bookshelves occupy the third and fourth floors. The fifth floor houses a loft of offices for museum staff and technical services. Below street grade Hartman placed two levels of parking, with floors engineered to allow for future conversion to document storage.

The building was constructed for an economical US$33 million with five storeys of steel-frame construction sitting atop two parking levels framed in reinforced concrete. The typical 30 by 30 foot structural bay set the order for the entire library, with two notable exceptions. First is the 90-foot-wide span over the lobby, accomplished with deep cantilevers that extend 21 feet into the space from each side and are joined by a 48-foot-long beam. In the 90-by-180-foot column-free work area on the fifth floor, the ceiling is supported by a series of Vierendeel trusses and penetrated by a series of sawtooth clerestories.

Daylight is deftly manipulated in the building's public spaces, especially in the reading rooms, which are shielded from direct sunlight by a combination of a *brise soliel* and light shelves. The abundant natural light in these spaces bounces indirectly off curved reflective ceilings. Specialised reading rooms on the front corners of the building are illuminated with a more diffuse light that filters in through fixed glass shades laminated with a rice paper core,

4: South, entrance elevation

5: Detail of the window wall



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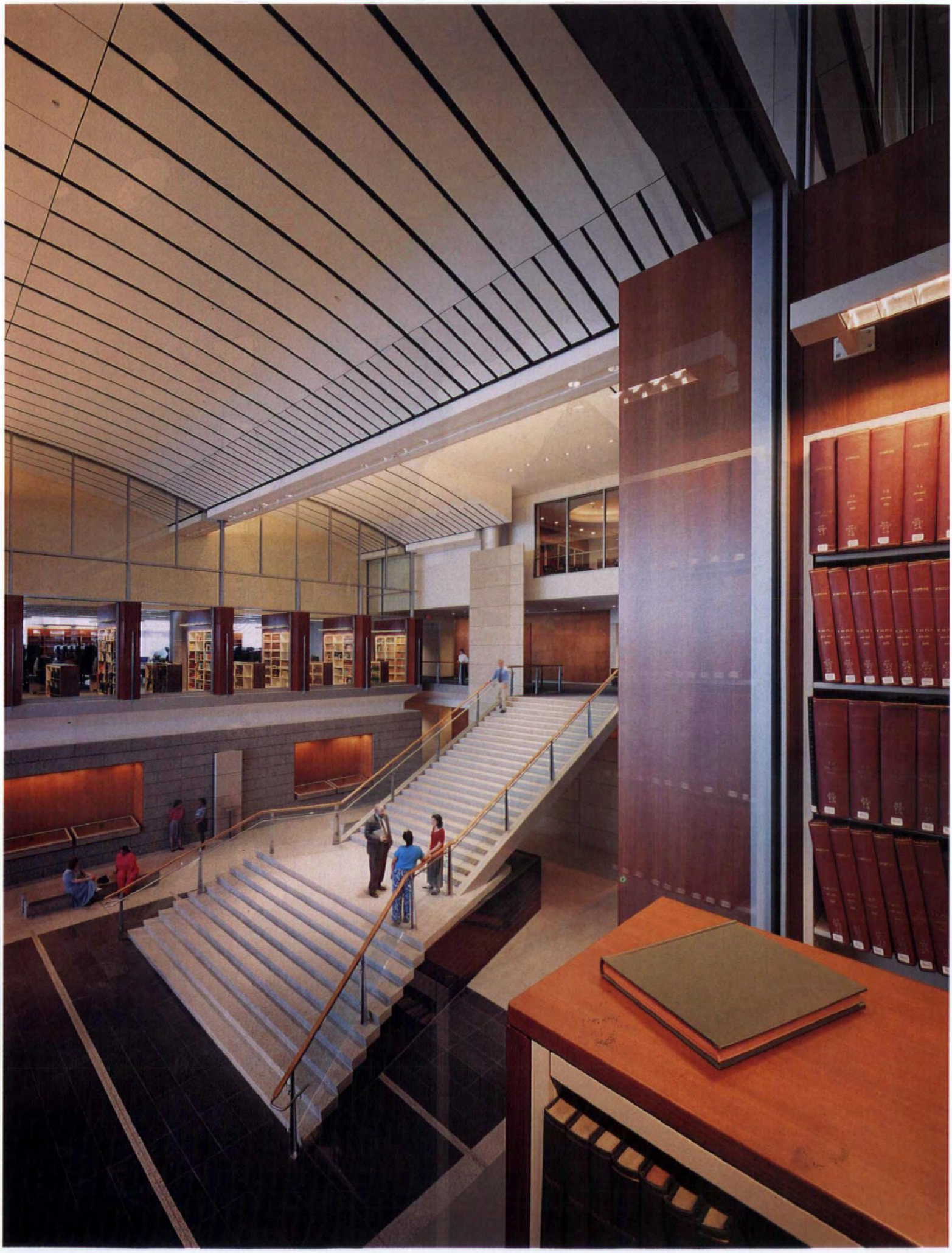

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› producing an effect not unlike the luminescent glow of traditional Oriental architecture.

On the exterior, the library is traditional in its massing but unabashedly modern in expression. Squares of limestone form a tight skin on the upper facade, which is punctuated by the richly articulated combination of grey aluminium panels, perforated-steel sunscreens, and glass. The wing-like form of the entry canopy, constructed of built-up T-sections and tapered structural members, projects 25 feet from the front of the building.

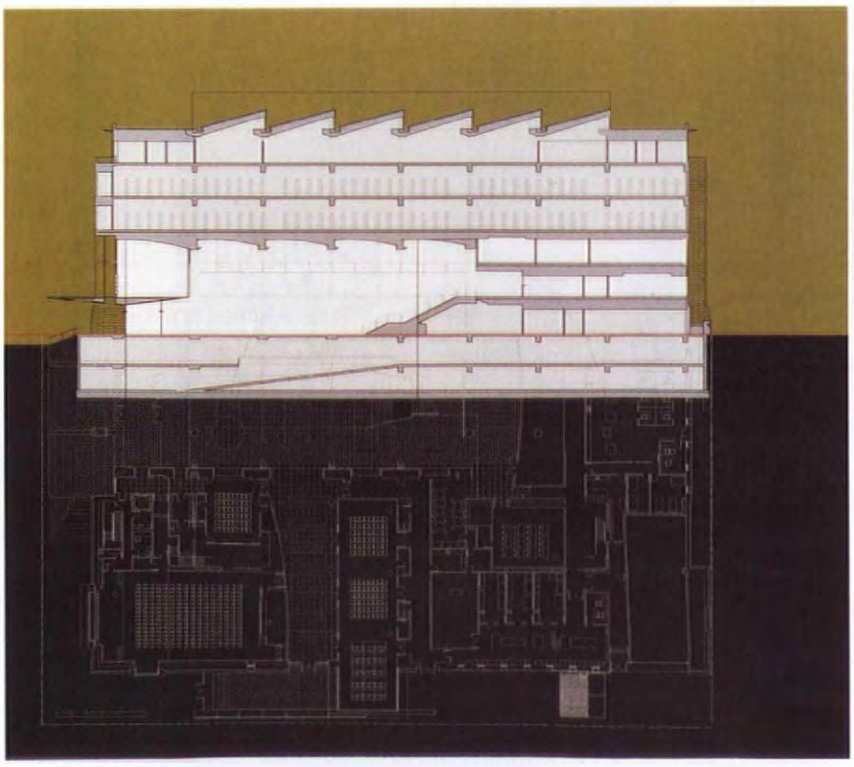
The completion of the new home for this ambitious institution puts Hartman in good company with SOM predecessor Gordon Bunshaft, who in an earlier era built both the Reynolds Metals headquarters and Philip Morris cigarette manufacturing plant nearby for two of Richmond's largest employers. But the stakes for the community are perhaps greater where the Library of Virginia is concerned. For by siting the building optimistically in the troubled heart of Richmond's downtown, the city also has placed high hopes on the library's ability to recharge the urban core. Knowledge, as they say, is power. Whether that includes the power to heal remains to be seen. WA

1: The library is entered under the "bridge" of the reading room above and into an expansive public space in which the open stacks may be viewed

2: North-south section through the library

Cost summary

Item	Description	Cost per square foot	Cost per square metre	% of total cost	Total cost
Foundations	Shoring, modified mat foundation & retaining walls	US$16.69	US$179.70	18.81%	US$6,007,000
Frame	Steel frame & concrete slab	US$8.10	US$87.20	9.13%	US$2,915,100
Roof	Built-up & metal standing seam	US$0.87	US$9.41	0.99%	US$314,597
External walls	Limestone & curtainwall	US$0.72	US$93.83?	9.82%	US$3,136,541
Internal walls	Drywall partitions	US$3.29	US$35.45	3.71%	US$1,185,000
External doors	Glass entrance, hollow metal & coiling service doors	US$0.29	US$3.16	0.33%	US$105,500
Internal doors	Hollow metal frames wood doors & hardware	US$0.63	US$6.79	0.71%	US$226,900
Wall finishes	Limestone, fabric panels Wood panelling & paint	US$5.71	US$61.50	6.44%	US$2,055,703
Floor finishes	Carpet, ceramic tile & wood	US$0.49	US$5.26	0.55%	US$176,000
Ceiling finishes	Drywall & acoustical tile	US$2.20	US$23.63	2.47%	US$790,000
Fittings & furnishing	Miscellaneous metals casework, toilet partitions & graphics	US$5.29	US$56.91	5.96%	US$1,902,306
Services	Elevators, booklifts, security, mechanical, electrical, fire protection & integrated management system	US$36.04	US$387.93	40.61%	US$12,968,092
External works	Sitework & utilities	US$0.42	US$4.53	0.47%	US$151,360
TOTAL		**US$88.75**	**US$955.29**	**100%**	**US$33,137,842**



2

Architects and interior design
Skidmore, Owings & Merrill (SOM)
Associate architects
The Glave Firm
Client
Virginia State Library and Archives
Structural engineer
SOM
Associate structural engineer
J D Daniels Engineering
Civil engineers
Advanced Engineering
Geotechnical engineers
Froehling & Robertson, Inc
Mechanical, Electrical, Telecommunication & Sanitary consultants
Hankins and Anderson, Inc
Cost consultant
Rackley & Associates

Interiors installation
Guathmey Design Group
Contractor
Gilbane Building Co (Construction Manager)
OMNI (Contractor)
Acoustical/Audiovisual consultants
Shen, Milson & Wilke
Lighting consultant
Claude R Engle Lighting Consulting
Landscape architect
Snead & Associates

Architects
Arquitectonica
Reviewed by
Beth Dunlop

Budget Disney

Disney All-Star Resorts, Orlando, Florida

Photographs by Dan Forer

1

2

Disney's All-Star Resorts in Orlando, a mammoth themed motel complex designed by Arquitectonica, explores the ideas and iconography of American pop culture. With 5,760 rooms divided among 30 low-slung buildings, it is indeed a motel for the masses. Except for the camp sites, All-Star is Walt Disney World's lowest-priced accommodation.

When the Miami-based firm Arquitectonica began on this project, economy was a primary objective; Disney was losing guests to the budget hotels lining the highways outside the theme part grounds. "The idea," said Arquitectonica founder and partner Bernardo Fort-Brescia, "was to put money into the details. We decided to look at the popular arts of entertainment, at sports, music, the movies and take those themes and turn them into popular architecture."

Thus came the first two of three phases: All-Star Sports and All-Star Music, with sections themed to basketball, tennis, surfing, jazz, calypso and rock 'n' roll. Each phase has five sets of paired units devoted to a single related theme with outsized iconography to match. Most hotels at Walt Disney World take their theming in a different direction. At hotels with turn-of-the-century architectural motifs (among them the Grand Florida,

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1: Site plan showing the T-shaped buildings in the first two of three phases for Disney's All Star Resorts; All Star Sports and All Star Music

2: Each themed hotel is defined by outsized iconography

3: View through a giant umpires whistle to the Hoops Hotel

4: The entrance to each complex is denoted by an enormous star, weighing 55,000 pounds

5: The All-Star Sports entrance with one-storey-high lettering

6: An overscale football helmet in one of the public spaces between the hotels

the Yacht and Beach Clubs and Disney's Boardwalk), the themes are executed as if guests were walking into a period film, with appropriately decorated interiors and even costumed staff. At All-Star, the approach is different; it is "theme-as-art".

Indeed, All-Star is to architecture what pop art is to art; the "details" are expressed with oversized images, surfboards or banjos blown up well beyond their actual size and used to clad columns or cover stairwells. Parapets appear as waves (in Surf's Up) or a musical score with canes and top hats (in Broadway). "It's a very American phenomenon, almost the same American culture as roadside architecture. Drive down the roads in the West and there's a big jack rabbit, a big cowboy hat, a big cup of coffee..." explains Fort-Brescia.

Disney first asked Arquitectonica to explore these ideas for an as yet unbuilt project for Disneyland Paris where the various hotels examine themes of American life and culture. "That's where we started exploring the idea of roadside architecture, though in that case it was related to the 50s, related to place as if you were driving across America."

In each of the themed areas T-shaped buildings face each other to form outdoor "rooms," the public spaces that are occupied by swimming pools, snack bars, walkways and often filled with giant "icons" such as basketball hoops. The buildings are not arranged with any attempt at symmetry, so that the spaces formed are typically less formal – trapezoidal or triangular – than a classical courtyard might be.

For each complex, All-Star Sports and All-Star Music, the innkeeping functions are central houses. Guests arrive and enter under a huge star weighing 55,000 pounds, check in and then disperse to their rooms. Shops and central eating areas with a variety of walk-up food purveyors are in the central pavilions. The three-storey buildings themselves return to a less technological era; the comparatively small and sparse rooms open onto open-air walkways rather than interior corridors. These hallways are, of course, masked by the pop-culture icons that adorn them.

Most of the "icons" are made of metal or fibreglass sprayed onto metal mesh; the effect is at once realistic and intentionally absurd, giant visual jokes. And yet, this is architecture to be taken seriously. Arquitectonica's work is often purposely improbable, a play on scale or size. In many cases, that is done in an abstract fashion, but at All-Star, realism rules – or at least a larger-than-life version of reality. WA

Client
Disney Development Company
Design architects
Arquitectonica
Executive architects
HKS Inc
Structural engineers
OE Olsen and Associates
M&E engineers
HC Yu and Associates
Civil engineers
Ivey Harris and Walls
Landscape design
Edward D Stone Jr and Associates
Landscape architect
Herbert-Halback Inc
Interiors
Design continuum
Graphics
Communication Arts Inc
Lighting
Grenald Associates

Architects
Odell Associates
Reviewed by
Chuck Twardy

A walk in the park

North Carolina State Engineering Graduate Research Centre, Raleigh

1

The Raleigh-Durham area's explosive growth, fuelled by hi-tech industry, prompts inevitable comparisons with California's Silicon Valley. For nearly 40 years the catalyst of regional economic development has been Research Triangle Park (RTP). The 6,800-acre campus attracts hi-tech industries by exploiting the proximity to the major research universities in the "triangle" – North Carolina State University in Raleigh, Duke University in Durham and the University of North Carolina at Chapel Hill. Started in 1959, the park attracted 66 companies in its first 30 years. Since 1989, however, it has drawn nearly half that amount, almost all hi-tech and communications firms. With its signature headquarter buildings on large, manicured lots fringed by forest, "The Park" has also provided a model for the region's growth, which has been largely suburban and automobile-dependent.

But a new model emerging at North Carolina State University stresses context and contact over isolation and insularity. The latest building to join the expanding university Centennial Campus core is the 138,000-square-foot Engineering Graduate Research Center (EGRC), set to open this autumn, which despite following the rigorous guidelines of the campus master plan, and bowing to its red-brick aesthetic, strikes a unique note among its

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1: The EGRC is the latest addition to the expanding Centennial Campus at North Carolina State University

2: The three-level curtain-wall, framed on the lower levels by precast concrete columns, uses clear glass in contrast to the mirrored glass of its neighbours

3: The arcade running between the plaza, on the left, and the laboratory on the right

3

Client
North Carolina State University
Architects
Odell Associates Inc
Marley Carroll Principal-in-charge
General construction
Fowler Jones Beers Construction
Plumbing
Bay Mechanical Inc
HVAC contractor
Atlantic Coast Mechanical
Electrical contractor
Wayne J Griffin Electric Inc

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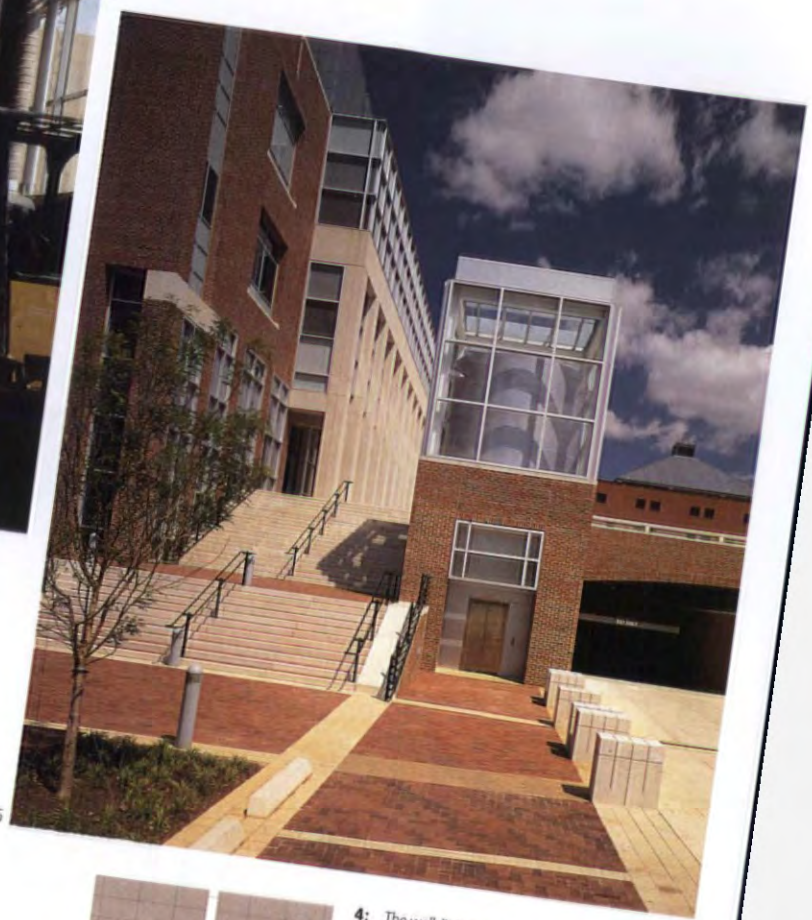
Photography Bryan Hofman



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neighbours. The Centennial Campus aims for a mix of uses, both among academic departments and between academia and business, thus advancing what RTP started. With long-term plans for residences, retail and mass-transit, the developing 1,000-acre campus addresses major concerns of "new urbanist" thinking, and might provide the region with its next growth model.

The campus plan groups buildings around plazas and informal gathering areas. Accordingly, the EGRC's 112,000-square-foot main building fronts a brick plaza. The university hopes to lure a private company across the plaza, so Marley Carroll, principal architect-in-charge, stipulated a front facade "advertising what goes on in here". The three-level curtain-wall, framed on the lower two levels by precast concrete columns, uses clear glass, instead of the mirror-glass found in other buildings on the campus. A ceramic frit blunts sunlight. Carroll designated this side of the building the main circulation area, where colleagues from various branches of the engineering school might meet. At the plaza level, they stroll along a brick-paved, glazed arcade, which sprouts a sequence of stairs linking all four levels.

Common areas, such as lounges, a library and a 100-seat auditorium, are located at either end of the four-level building, with offices occupying four arch-roofed pods projecting from the west facade. Laboratories and research facilities fill the core of the building, among them two floors of air-locked and specially-ventilated "clean rooms" for the school's Advanced Materials Teaching and Research Center. Four aluminium-panelled boxes rising from the roof partly shield exhaust systems.

The EGRC also comprises a separate, 26,000-square-foot Structures Laboratory for testing structural designs. A long, two-storey space with a trussed roof rests on two-foot-thick catacomb walls. The floor is punctured with a grid of holes, to which structures will be bolted while they await their fates under hydraulic presses. This offers a gritty counterpoint to the hi-tech ambience of the main building. The plaza covers a 348-space parking garage. This obviates the otherwise obligatory parking lot, which would have played havoc with the clustering concept of the campus plan. Credit should go to the university, and the state, which provided the US$42 million for the project and are taking on the additional expense of the garage. If the campus plan is followed, the automobile, as well as the parking lot, might be eliminated. And that would obviate comparisons with Silicon Valley.

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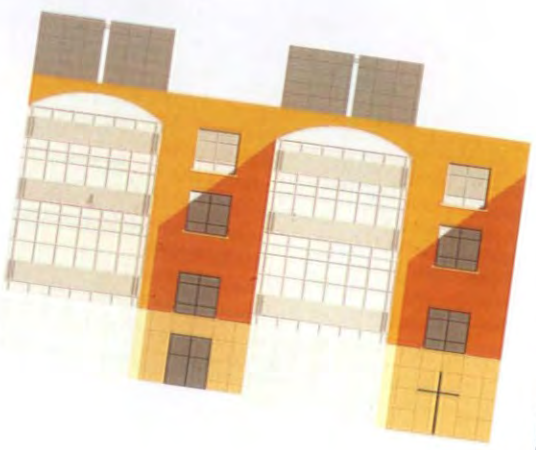

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4: The well-lit interior of the high-bay Structure Laboratory used for testing structural designs

5: Steps leading up to the entrance plaza, with the elevator tower for the parking deck below

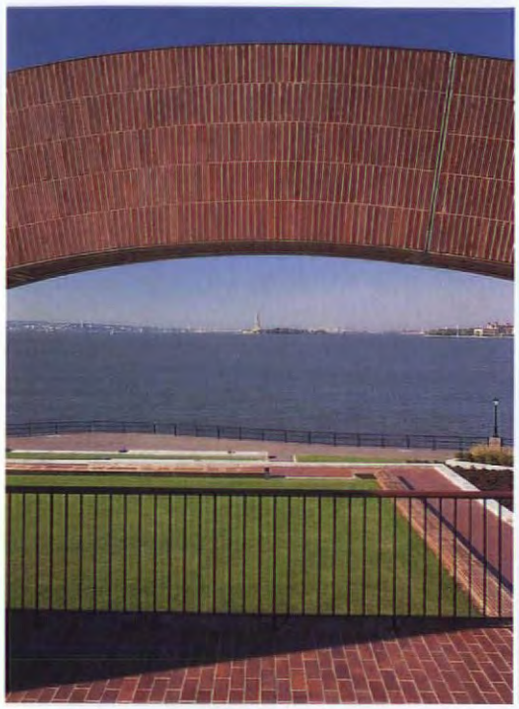
6: Partial east elevation

7: Partial west elevation

Architects
Machado and Silvetti with the Olin Partnership
Reviewed by
Judith Davidsen

Harbouring views

Wagner Park, Battery Park City, New York



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Photography by Peter Aaron/Esto

1: Detail of the brick-clad arch from the second level of the pavilion

2: A cafe nestles under the arch to the right of the pavilion; the entrance to the restrooms is through the arch to the left

3: Two allées converge at a 34-foot-high pavilion framing a view to the far side of the harbour

Battery Park City (BPC), the combination financial centre and residential enclave that began to rise on Manhattan's lower Hudson River shoreline over a decade ago, was originally trumpeted as an offshoot of Wall Street, bracketed by multi-family housing in architectural styles reminiscent of New York's elite pre-shoe-box apartment houses. However, it is the 92-acre development's open spaces that have made it famous – beginning almost at its inception with a mile-long riverfront esplanade and concluding, at its southern terminus, with the newly opened Robert F Wagner Jr Park designed by the Boston architecture firm of Machado and Silvetti with the Olin Partnership – the Philadelphia-based landscape architecture firm responsible for the esplanade.

The design is deceptively simple. Two allées, extensions of local walks, converge at a 34-foot-high masonry-clad bridged pavilion that frames a distant view across a neat lawn to the Statue of Liberty on the far side of New York Harbor. The pavilion roof offers alternative harbour perspectives – one framed by an arch, the other wide open in all directions – along with benches and tables. Restrooms, elevator access, a park-maintenance shop, and a cafe designed by Victoria Rospond are tucked underneath.

The 3.5-acre site projects a strong presence amid such colossal surroundings as the harbour to the west and south, and, to the north and east, the World Trade Center, the World Financial Center, the high-rise apartment houses of Battery Park City and the office towers of New York's financial and shipping districts. Far from dwarfing the park the famous skyline appears to rest on the overscaled, muscular masses and arches of the pavilion as on a plinth. At pedestrian level, intricate brick patterning helps restore human scale.

On the city side, two grand staircases leading to the roof-level observation posts also embrace an amphitheatre space for outdoor performances, and can become part of the stage set. The structure, the allées and the sinking of flower beds combine on this side to create a microclimate conducive to an English-style garden.

Battery Park City, only half built when the economic slowdown hit in the late 1980s, is on the move again. Directly north of Wagner Park, the Living Memorial to the Holocaust Museum of Jewish Heritage, designed by Kevin Roche and John Dinkeloo, is scheduled to open later this year. At the financial core of Battery Park City, Skidmore, Owings & Merrill have just completed a new state-of-the-art Mercantile Exchange with 42,000- square-foot trading floors, and construction on a nearby hotel by Perkins Eastman is scheduled to begin in December. At the northern end, 42-storey housing by Gruzen Sampton, and 27-storey housing by Robert AM Stern and CK Architects are planned, along with a residential/school ensemble designed in the warehouse vernacular of the adjacent Tribeca neighbourhood by Richard Cook & Associates, Pasanella + Klein, Stolzman + Berg, and CK Architects. Designers have not been chosen yet for senior/assisted housing planned for this area. Perhaps the rebounding economy is responsible for renewed developer interest in the northern section, but the fact that its parks and open spaces are already in place and attracting enthusiastic use certainly hasn't hurt. WA

Client
Battery Park City Authority
Architects
Machado and Silvetti
Landscape architects
Olin Partnership
Garden designer
Lynden B Miller

Architect
Kohn Pedersen Fox Associates
Reviewed by
Raul Barreneche

In a world of its own

World Bank Headquarters, Washington, DC

Despite its status as a world capital, Washington, DC, remains one of the most architecturally unadventurous cities in the US. Its monumental core of museums and government buildings is filled with cold, classical blocks, while its downtown district is replete with atrocious post-modern offices built during the 1980s real estate boom. One important new downtown building, however, stands out for favouring sleek modern moves over classical allusions. The new US$149 million headquarters for the World Bank, designed by New York-based architect Kohn Pedersen Fox Associates (KPF), is by far the most elegant new building in Washington, and one of the most skillful in KPF's impressive portfolio. The building reflects the refined, stream-lined modern style the firm has developed over the past several years.

Since its inception in 1945, the World Bank has amassed a collection of over a dozen bunker-like office buildings, spread out over several downtown blocks just west of the White House. The institution's functional and symbolic heart was a single trapezoidal block along Pennsylvania Avenue, which was filled with a mish-mash of a six interconnected buildings dating from the mid-1940s through the late 1960s. Frustrated with this amalgam of dark, outdated edifices, the World Bank held an international competition in 1990 to design a new flagship building with an updated image.

KPF won the competition over 150 of the world's leading firms, primarily on their proposal's strength in maximising daylight in the new building and achieving the greatest floor area ratio for the site. KPF was the only firm to retain two of the original 1960s buildings along the south and west edges of the site one designed by Gordon Bunshaft of Skidmore, Owings & Merrill fame, the other by Philadelphia modernists Kling Lindquist Partnership, and weave them together with a new structure. In addition to an obvious cost-reduction, saving the original buildings allowed roughly a third of the bank's 6,000 employees to continue working in their old offices during construction.

KPF replaced the demolished buildings with two new structures wrapped in an L-shaped configuration around a monumental atrium. The architect built these new structures atop existing foundations and joined them to the original buildings inside and out. The project was built in two phases, the first of which was completed in 1994; the second, more comprehensive phase was finished this year. KPF's addition, cloaked in a sleek skin of concrete, steel, and glass, blurs distinctions between old and new. To create the visually seamless addition, the architect wrapped all four buildings in a continuous stone plinth, and reclad the Bunshaft building to harmonise with its new neighbours. Its most elegant exterior feature is a canted glass curtain wall extending almost the full length of the site, that appears to float above concrete pilotis.

Inside, KPF chose a subdued material palette of tile, wood veneers, and metal panels. The building's most spectacular interior feature is the huge atrium topped by a vaulted skylight. Although the atrium is monumental, watercourses, plantings, sculptural columns, and a sea of Saarinen tables and yellow and lilac cushioned Bertoia chairs bring its scale down to a human level. Despite the building's transparent public face and its air of openness and accessibility, the World Bank remains a rather closed institution, with tight security checkpoints, turnstiles, and metal detectors lurking just behind the glassy facade. Still, KPF's scheme brings a welcome infusion of transparency and light to an otherwise dark urban district. WA

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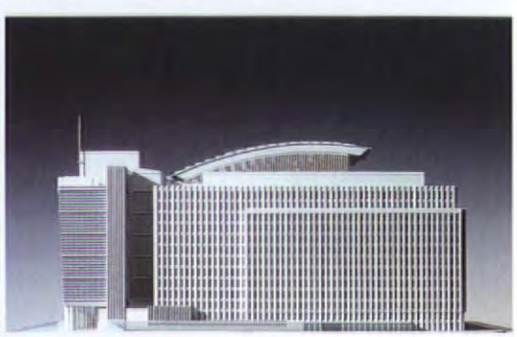

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1: The vaulted skylight under construction. The bank was recently completed, but further photography is not permitted until later this month

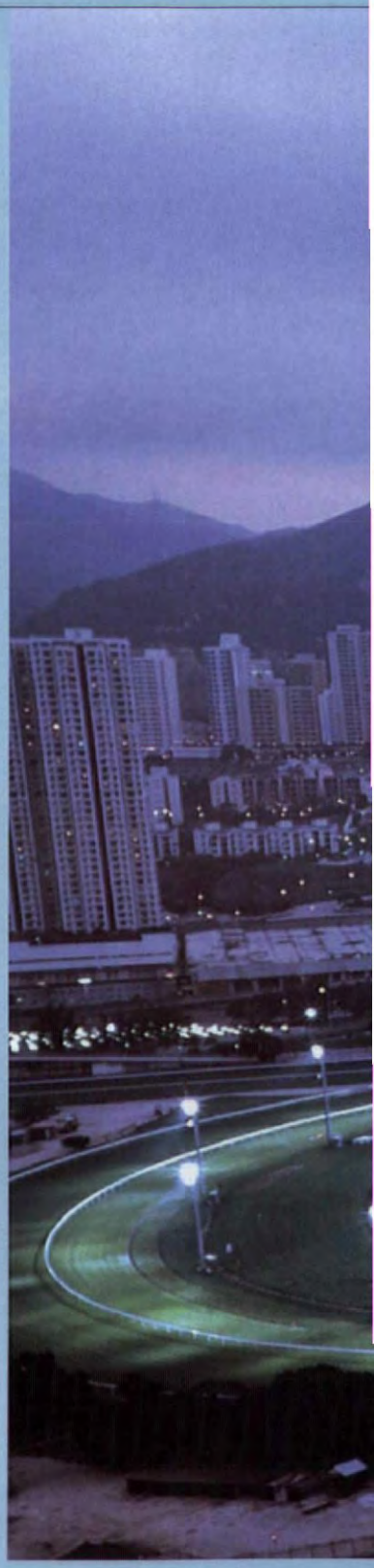
2: The vast ecclesiastical space of the atrium

3: Model shot showing the canted glass curtain wall above concrete pilotis, extending almost the full length of the site

Client
The World Bank
Structural engineer
Weidlinger Associates
Mechanical engineers
Flack & Kurtz
General contractor
The George Hyman Construction Co

Leigh & Orange: building on gold-dust

Leigh & Orange are Hong Kong's oldest firm of architects. When they were founded, the territory was little more than an obscure trading post in one of the farthest flung corners of the British Empire. As colonial architects and engineers, they worked on every conceivable kind of project both for the government and other institutional clients and for many years were the foremost practice in Hong Kong. The result was a firm with a broad range of skills, but also one that by the early 1980s was finding it necessary to adjust to Hong Kong's modern free-wheeling economy. Now, after a period of reform and readjustment that has resulted in straight line growth over the last ten years despite the recession in the world economy, Leigh & Orange have emerged much enlarged and reinvigorated, with a substantial international presence in Asia and a relaxed optimism about Hong Kong's future under new management. Tim Ostler reports.



Evening view of Shatin Racecourse. Most of Hong Kong's CBD and all of the racecourse is built on reclaimed land

An architect in Hong Kong is like a gardener in a rainforest. Working fast is part of the job description. In the city's densest thickets, no sooner is one tottering 40-storey block of flats demolished than another rises from the undergrowth to exploit its view.

To have survived here for over 120 years is quite an achievement, but Leigh & Orange are long-established even by international standards. As Sharp & Danby, their origins can be traced back to 1874, within sight of the Opium Wars. They became Leigh & Orange in 1894 and have retained the name ever since. Many of Hong Kong's colonial landmarks, from the University's Lok Yew Hall of 1912 to the Mandarin Oriental Hotel, built in the 1960s, are the work of the firm.

The firm's longevity is particularly striking because at root it is essentially a partnership, a form that in some other countries often fails to survive its founders' retirements. But according to Principal Director Terence Smith, the firm's enduring partnership owes a lot to its expatriate origins. "It's an old colonial system," he explains. "You never make people pay for goodwill." Colleagues selected for partnership status are not therefore required to invest vast amounts merely to become partners; nor when they retire can they withdraw large sums that may leave the firm financially crippled. In addition, all the members of the partnership are entitled to an equal share in the profits which has been proved to foster harmonious working relationships between the partners.

One of the effects of this policy has been to make partnership available to talented architects within the firm who are thought able to contribute and carry the firm forward. As a result the firm has successfully negotiated its own process of transition from colonial implant, through local indigenous practice, to international design firm headquartered in Hong Kong. In view of this, Leigh & Orange seem rather a good subject for a *Profile* to mark the return of the territory to the mainland. There's just one small thing: according to Smith and all of his partners, the handover is an economic non-event.

Smith was already writing it off last year, when interviewed for the *WA World Survey*. "It's already happened," he said then. "The whole of the manufacturing industry has gone across the border into China, which is now inescapably part of the family of world trading nations..." He has not changed his view since. China is still talking socialist and acting capitalist; and Deng's idea of one country two systems he says was a brilliant solution for Hong Kong. Accordingly, with Hong Kong's new regime staffed largely by millionaires, there seem good grounds for believing that Hong Kong's business-friendly political climate will survive.

Meanwhile, according to Dominic Lam, partner in charge of most work on the mainland, Leigh & Orange's longevity actually gives the firm a certain marketing cachet when seeking work in China. Other legacies of empire also seem secure. One British import that, like Leigh & Orange, has taken root is the Jockey Club. In addition to the tens of thousands who watch races in person twice a week, many more place bets through what is probably the most advanced telephone-betting system in the world. Still more thousands owe their living to it, whether directly or indirectly.

It is a mark of Leigh & Orange's standing in the territory that they have been closely involved with the Club for over 50 years, having designed all of the original stands at the course in Happy Valley. More recently, under former senior partner Frank Eckerman, they were masterplanners, architects and engineers for the new course at Shatin in the New Territories. Partner Leo Barretto, a native of Hong Kong, is uniquely qualified to maintain this connection. Son of a former secretary to the Club, he grew up immersed in the culture of horse racing. What is perhaps surprising is that he only began to be actively involved in racecourse design in the 1980s with Eckerman's retirement.

Smith, meanwhile, an Englishman trained in Leeds, is an ebullient man who until recently regularly opened the bowling for his

"We're competing with the best in the world – KPF, SOM, Foster et al – all the time now. The firm is no longer only a local Hong Kong firm."

1: The directors of Leigh & Orange discuss a model of the Cloudlands Residential Development in Hong Kong

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2: The Mandarin Oriental Hotel, built in the 1960s

3: Concept sketch for the Tai Hu Centre, Suzhou, Peoples Republic of China. Note the visual reference to the sails of the traditional Chinese junk

4: Model view of the Tai Hu Centre

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local cricket team. After 20 years as a partner he remains strikingly unaffected: it is clear that he still finds the whole business of working in Hong Kong enormous fun. He is fond of pointing out that if you draw a circle on a map centred on Hong Kong with a radius of six hours' flying time, you will take in half of the world's population. That's some home market, and one that his firm is actively developing, with offices in Melbourne, Bangkok, Taipei and Manila, as well as several others in China including Shanghai.

For Leigh & Orange, work on the mainland has played a crucial part in opening up new areas of practice. Once largely trapped by its image as a designer of institutional building types, thanks to its projects in China the firm has been able to branch out and extend its range to include offices and commercial development. Its success in this department can be gauged by the fact that the World Finance Centre, currently under construction, will be the second-tallest building in Shanghai.

Leigh & Orange, like all Hong Kong architects are quite at home with building high. They have to be: with 18,000 people to be housed per square kilometre of buildable land, land is a scarce commodity. "Land is like gold-dust, here," says Smith. "You just can't get it." If you can't get it, you have to make it: most of Hong Kong's central business district (and all of Shatin Racecourse) is built on reclaimed land.

The other consequence is that massive housing developments may be built on sites so steeply sloped that in any other part of the world they would not even be looked at. In some cases a third of the cost of a building may be spent merely in making a site buildable.

One of the most interesting aspects of Leigh & Orange is the fact that it continues to adopt the British model of practice even in extreme circumstances such as these. The firm provides a full service based on the RIBA Plan of Work, while operating in an environment where the pace of development is vastly different – arguably closer to that in the United States than the UK. If nothing else this suggests that the British system can work just as well as any other, even in the most accelerated professional environment in the world. "We do follow the English tradition," says Smith, "in terms of the right way a project should be approached in all its phases. But we tend to cut corners a bit, in the sense that we have to comply with extremely tight deadlines and fast tracking is the norm.

"Hong Kong is a prime example of getting things done quickly. Whether it's an enormous housing programme or building an MTR, we get on with it quickly. And that ethic pervades the whole of business life here. In China, Dominic, Sebastian (Law) and Willy (Chan) have been working to tremendously tight deadlines to produce designs for sometimes massive schemes."

Somehow, work continues at this pace without losing sight of quality management. Leigh & Orange were only the second firm

"Hong Kong is a prime example of getting things done quickly. And that ethic pervades the whole of business life here."

in Hong Kong to receive certification under ISO 9000, and this without any nonconformities. "We wrote our own management system," says Smith, "and this helped to formalise the way we managed ourselves. It helped to show not only where there were some gaps but also where we were doing it right already, which was largely the case." The company has a senior full-time staff member with an assistant whose remit is solely to do with quality issues. "Its a great management aid," says Smith. "The return is that you only ever do things once."

In addition, L&O Australia offers specific expertise in materials and building technology and this is regularly drawn upon to ensure a high quality is maintained in all L&O projects right down to the detail design.

If Leigh & Orange seem to be thriving, it was not always so. There was a time, in the late 1970s, when the firm was in danger of getting stuck in a steadily diminishing rut. A classic case of continuing to rely soley on existing clients without investing for the future in a developing market. As Hong Kong's economy grew, Leigh & Orange's client base declined. There was a drop-off in staff numbers, several of whom left to found firms that are now major players in the local market.

By the time that Smith and Barretto became partners in the late 1970s, staff numbers were down to about 30 or 40. They realised that something drastic had to be done, and a major effort was made to widen the scope of their activities and to attract the brightest graduates. The prosperity of the firm today is the direct result of that deliberate shift in emphasis. "I would like to say that it has been the result of brilliant management," says Smith, "but the truth of the matter is that the firm's growth has taken place on the back of Hong Kong's economic miracle. We had to bring in new young people of course – that brought in a new freshness – and we concentrated on expanding our market share and our areas of expertise."

It has also brought Leigh & Orange a distinctly different image. "There is no doubt," says Smith, "that when Leo and I took over we were perceived as a traditional architectural firm that would produce first-class work and deliver what we promised. But we perhaps lacked an architectural sparkle and we were perceived as trailing behind in international architectural ideas.

"We needed very much to change this view. We have brought in younger people and focused on design issues and the result is we've been increasingly successful in convincing clients that we are now taking a more adventurous approach to the way we put buildings together."

The most important practical effect of this new image is that Leigh & Orange are being invited to pitch for a range of projects

1: The old and the new Hong Kong University's Lok Yew Hall from 1912

2: Proposed warehouse building in Kwai Chung

for which they would never have been in the running before. "We're competing with the best in the world – KPF, SOM, Foster et al – all the time now... It's important to stress that the firm is no longer only a local Hong Kong firm. We've now grown out of that phase and are competing successfully at all levels with the best in the world."

Leigh & Orange's advancement continues alongside the growing sophistication of Hong Kong itself. Environmental concerns are of increasing importance and the Hong Kong government is committed to the idea of energy conservation and combating pollution in all its forms. Smith sees the architectural profession as having a central responsibility in this movement and accordingly L&O are increasingly adopting a "green" environmentally sensitive approach to the design of all their buildings.

Of interest is the fact that, unlike so many firms elsewhere in the world which tend to specialise either by design or necessity, Leigh & Orange are still able to offer so many diverse design skills. This trait has obviously arisen from necessity during their formative past which required them to turn their hand to most things, but clearly, in the successful drive over the last 15 years or so to develop the architectural sparkle the trait has flourished. Now in addition to its world-renowned racecourse design skills and newly developed expertise in commercial buildings it is tackling projects as diverse as theme parks to warehouses, TV stations to luxury hotels, research laboratories to railway stations.

Also, in an inspired move in the mid-1980s Leigh & Orange took over the Hong Kong office of the London based John R Harris Partnership to reinforce the medical expertise offered by the practice, and with Willy Chan thereby joining the firm this resulted in Leigh & Orange winning a number of large and important government hospital commissions on the back of Hong Kong's drive to improve its health and welfare system. Again the expertise base of the practice was widened.

The spin-offs of this diversity is, as Smith says, "greater insulation than otherwise in financial terms from the vagaries of the inevitable economic cycle, ability to plan long-term, and retention of key staff who can be offered a proper career structure and who are constantly stimulated creatively by a wealth of new architectural problems."

Like space exploration, war, or motor racing, working as an architect in Hong Kong will increasingly force the development of skills and technology that can be reapplied in other, less demanding situations. There is probably very little, for instance, that any other firm of architects could teach Leigh & Orange about building large buildings on steep slopes and reclaimed land, or rapidly creating efficient plans, or in managing construction access to pocket-handkerchief sites whatever type of building is required.

What will be interesting will be to see to what extent architects who, like Leigh & Orange, have successfully confronted these issues on their home ground will be seen practising their skills more widely on the world stage.

Leigh & Orange company data

Principal Directors
Terence E. Smith, Dip Arch, RIBA, HKIA, AP, Reg Arch
Leo A. Barretto, Dip Arch, RIBA, ARAIA, HKIA, AP, Reg Arch
Dominic K. K. Lam, BA, B Arch, RIBA, ARAIA, HKIA, AP, Reg Arch
Wilfred N. P. Chan, MA (Cantab), Dip Arch, RIBA, HKIA, AP, Reg Arch
Hugh Zimmern, MA, Dip Arch, RIBA, HKIA, Reg Arch
Sebastian Law, BA, B Arch, ARCUK, RIBA

Directors
Paul Clarke, Dip Arch, RIBA, HKIA, Reg Arch
David N. Stanford, Dip Arch, RIBA, Reg Arch
Pansy L. B. Lam, MBA, Finance Director & General Manager
Lucy L. Y. Tsui, B Arch, Director, L&O (China)
Peter J. Smithson, B Arch (Melb), ARAIA, Reg Arch, Managing Director, L&O (Australia)
William J. Parker, B Bldg (Melb), Director, L&O (Australia)
John L.R. Crozier, B Ec, LLB, CPA, Director, L&O (Australia)
Prapon Lohsisupachai, B Arch, Reg Arch (Thai), Director, L&O (Thailand)
Thomas R. C. Lyall, Dip Arch, RIBA, Director, L&O (Thailand)
Wain Lai Pau, B Arch, Tong Ji University of China, Director of Leigh & orange Design & Project Development Consultants (China) Ltd

Offices
Hong Kong
6/F, 88 Hing Fat St, Causeway Bay, Hong Kong
Telephone: +852 2806 1312

Taiwan
L&O Consultants Ltd – Taiwan Branch Office
2F-1, Metropolitan Mansion, 71 Jen Ai Road, Section 2,Taipei, Taiwan, ROC
Telephone: +886 2 357 6238

Australia
Leigh & Orange Pty Ltd
67-71 Stead Street, South Melbourne 3205, Australia
Telephone: +613 9686 9900

Thailand
Leigh & Orange (Thailand) Ltd
37 Sukhumvit 19, Bangkok 10110, Thailand
Telephone: +66 2 253 5419

Myanmar
Leigh & Orange
32F Pyay Road, Hlaing Township, Yangon, Myanmar
Telephone: +95 1 532163

Philippines
Leigh & Orange
1411 Pacific Place Condominium, Pearl Drive, Ortigas Centre, Pasig City, Metro Manila, Philippines
Telephone: +63 2

Leigh & Orange Design & Development Consultants (China) Ltd
Hong Kong
6/F, 88 Hing Fat St, Causeway Bay, Hong Kong,
Telephone: +852 2806 1312

Suzhou
Suzhou Institute of Architecture Design, 143 Renmin Road, 2/F, Suzhou, Jiangsu, PRC
Telephone: +86 512 221148

Fuzhou
Fujian Architectural Design Institute, 188 Tong Hu Road, Fuzhou, Fujian, PRC
Telephone: +86 591 751 3891

Haikou
Mei She River Development District, He Wan Villa No 2, Haikou, Hainan, PRC
Telephone: +86 898 332716

Shanghai
5F-G, Block 1, Shanghai Jinxiu Business Centre, 825 Zhao Jia Bang Road, Xu Jia Hui District, Shanghai, PRC
Telephone: +86 21 6487 7420

Representative Clients
Hong Kong University
The Hong Kong Government
Chinese University of Hong Kong
City Polytechnic University
Hong Kong Polytechnic University
The Hong Kong Baptist University
The Hospital Authority
The Hong Kong Housing Authority
The Hong Kong Housing Society
Kowloon-Canton Railway Corporation
The Mass Transit Railway Corporation
The Hong Kong Jockey Club
The Hong Kong Telephone Company
Hutchison Telephone Hong Kong Ltd
Mandarin Communications Ltd
Cheung Kong Holdings Ltd
New World Development Company Ltd
Kerry Properties Ltd
Ocean Park Corporation
The Hong Kong Land Company
Hongkong & Shanghai Banking Corporation
Swire Properties Ltd
Citic Pacific Ltd
National Broadcasting Corporation
Star TV
Metro Broadcasting Corporation
Selangor Turf Club
Singapore Turf Club
Aman Hotels
Ritz Carlton Hotel Company
Mandarin Oriental Hotels Ltd
Eton Properties Ltd
The Hong Kong Cheshire Homes
Cannossian Colleges and Schools
Tung Wah Group of Hospitals
Caritas Hospital
Young Men's Christian Association
Marks & Spencer Far East
Royal Society for the Prevention of Cruelty to Animals
Way Foong Property Ltd
Henderson Land Development Company Ltd
China Resources Ltd
International Terminals Ltd
The Equestrian Club, Riyadh
The Hong Kong Land Development Corporation
Ayala Land

Quezon City Development Manila, the Philippines

Brief:
Ayala Land, the largest and most prestigious real estate development company in the Philippines, invited Leigh & Orange to submit designs in a limited architectural competition for a mixed-use commercial development comprising a 870,000-square-metre shopping centre, six large cinemas, 60,000-square-metre office space, 140,000-square-metre residential, and a 125-room hotel.

Challenge:
To organise the considerable amount of diverse accommodation in an architecturally exciting manner to provide a landmark development in Quezon City, but which at the same time was to be extremely functional, cost effective, highly efficient in planning terms, susceptible to phased construction, and sensitive to the local environment.

Solution:
The retail accommodation covering 70 per cent of the site area and planned around a large central naturally-lit atrium space, is housed in a five-storey podium, built over a five-storey basement car park and service area.

The office, residential, and hotel accommodation is housed in seven towers of varying heights located around the edge of the podium so leaving its central area free of structural obstruction to accommodate the cinemas and, by taking the tower forms to ground, giving the opportunity to reduce the visual mass of the podium at ground level. The pedestrian and vehicular access and circulation is separately arranged for each type of accommodation.

Considerable effort has been made to adopt an architectural language that unifies the diverse nature of the accommodation so it is seen a a total architectural statement which is effective as a landmark development.

Date:
1997

Project team:
Willy Chan, Belinda Ho, Rolly Miranda

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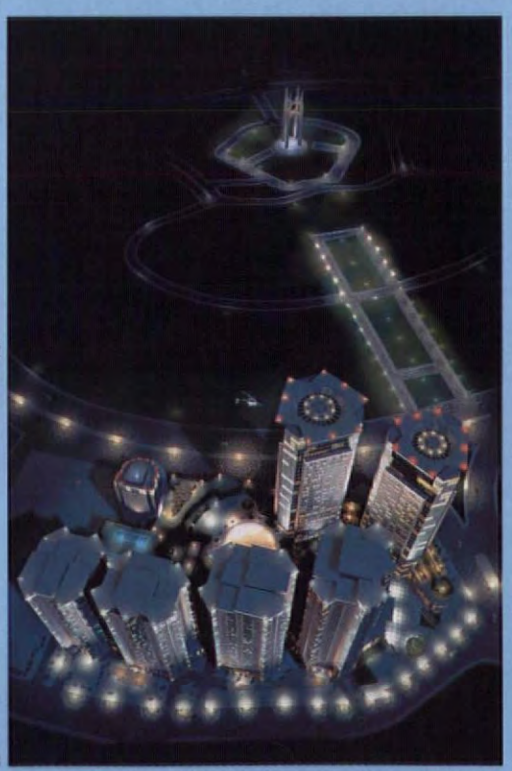

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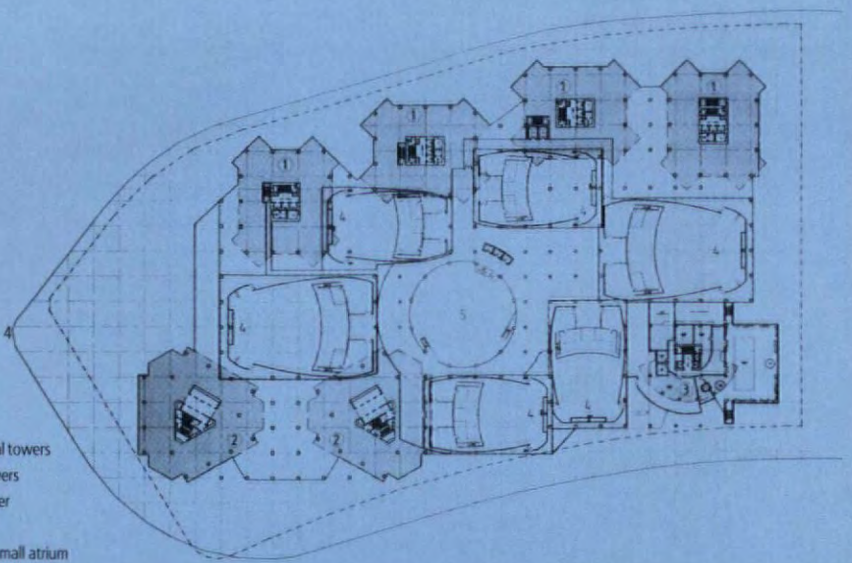

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Key
1. Residential towers
2. Office towers
3. Hotel tower
4. Cinemas
5. Shopping mall atrium

1&2: Two model elevations with the shopping mall atrium in the centre

3: Night perspective – bird's eye view

4: Site plan

Cloudlands Residential Development
The Peak, Hong Kong

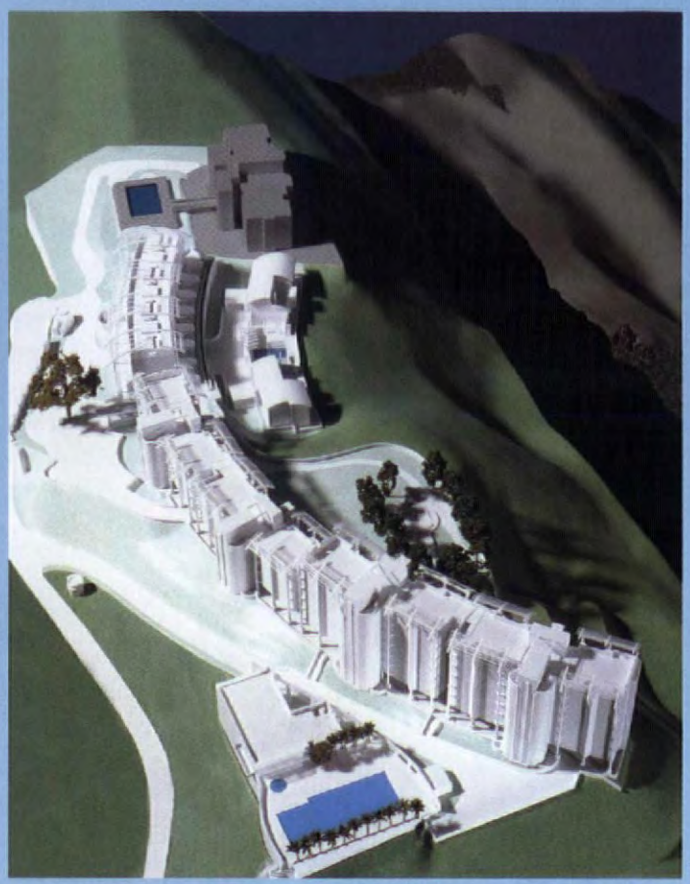
Brief:
The project was the subject of a limited competition with an open brief to design luxury townhouses and apartments for senior banking staff.

Challenge:
It was important to do justice to the site, which consists of two parcels of land beautifully situated on the Peak, the most exclusive residential area in Hong Kong, with views over the Lamma Channel to the south and Hong Kong harbour to the north.

Solution:
Leigh & Orange's scheme was unique amongst the competition entries in that its disposition was not as separate blocks, but as a single stepped block, for the most part lifted on pilotis, curving across the site in a subtle arc. This followed as a natural consequence from a key design decisions to echo the ridge line of the site, take advantage of the view opportunities and maximise the amount of open landscaped space at ground level. A graceful system of curved sun-shades above the roofs softens the roofline and echoes the curve of the plan.

Date:
1997

Project team:
Max Benthall, Belinda Ho, Stuart Price, Terry Smith, Hugh Zimmern



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1: The scheme creates a subtle arc curving across the site and minimises the need for intrusive driveways

2: Site plan showing disposition of main elements

3: Typical first floor plan of apartments

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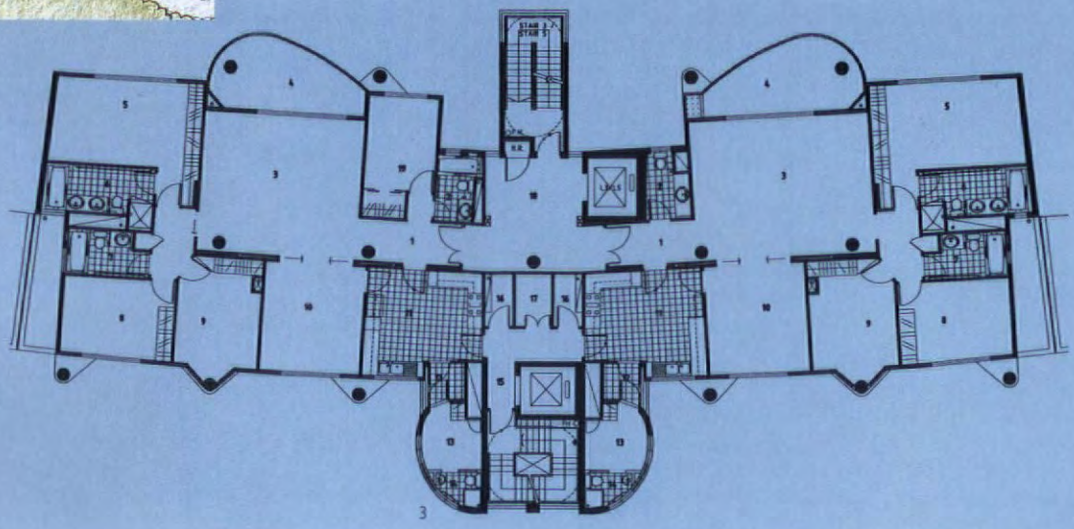

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1 Hall
2 Bathroom 1
3 Living room
4 Balcony
5 Master bedroom
6 Master bathroom
7 Bathroom 3
8 Bedroom 2
9 Bedroom 1
10 Dining room
11 Kitchen
12 Utility
13 Maid's room
14 Bathroom 2
15 Lobby
16 Box room
17 L/V riser room
18 Lift lobby
19 Bedroom 3

Biological Sciences Building
Main Campus, Pokfulam, Hong Kong

Brief:
New research and teaching laboratories for the Biological Sciences faculty.

Challenge:
The new building is situated overlooking the main entrance and immediately adjacent to the University's main building, Lok Yew Hall (itself designed by Leigh & Orange in 1912). Geotechnical considerations required that the building rest on as few columns as possible.

Solution:
The laboratory facilities are housed in two very stiff multi-storey concrete boxes which are lifted some ten metres above the site and supported on upturned pyramidal columns which limit the foundation supports to just four piles for each box. The boxes are connected at each level by a central core and form highly flexible and highly serviced lab spaces all with controlled environments. All major services are located outside the boxes and on the east and west elevations services are screened by glazed screens hung from exposed rooftop steelwork giving substantial energy efficiency. Advanced filtration technology used for the fume cupboards makes it unnecessary to take outlets to rooftop level for dispersal.

Date:
1998

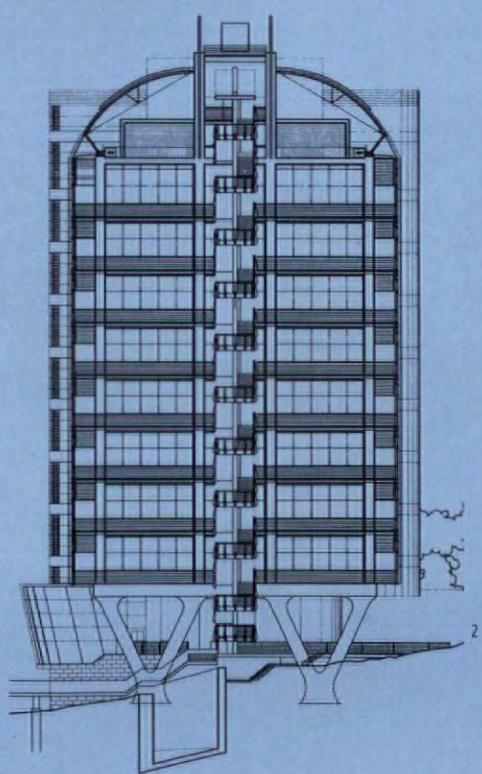
Project team:
Leo Barretto, Sarah Boden, Gordon McQuade, Terry Smith, Gabrielle Tsui

1

1: The new Biological Sciences Building sits adjacent to Lok Yew Hall, also designed by Leigh & Orange

2: South elevation

3: Diagrammatic cross-section showing heating and ventilation details



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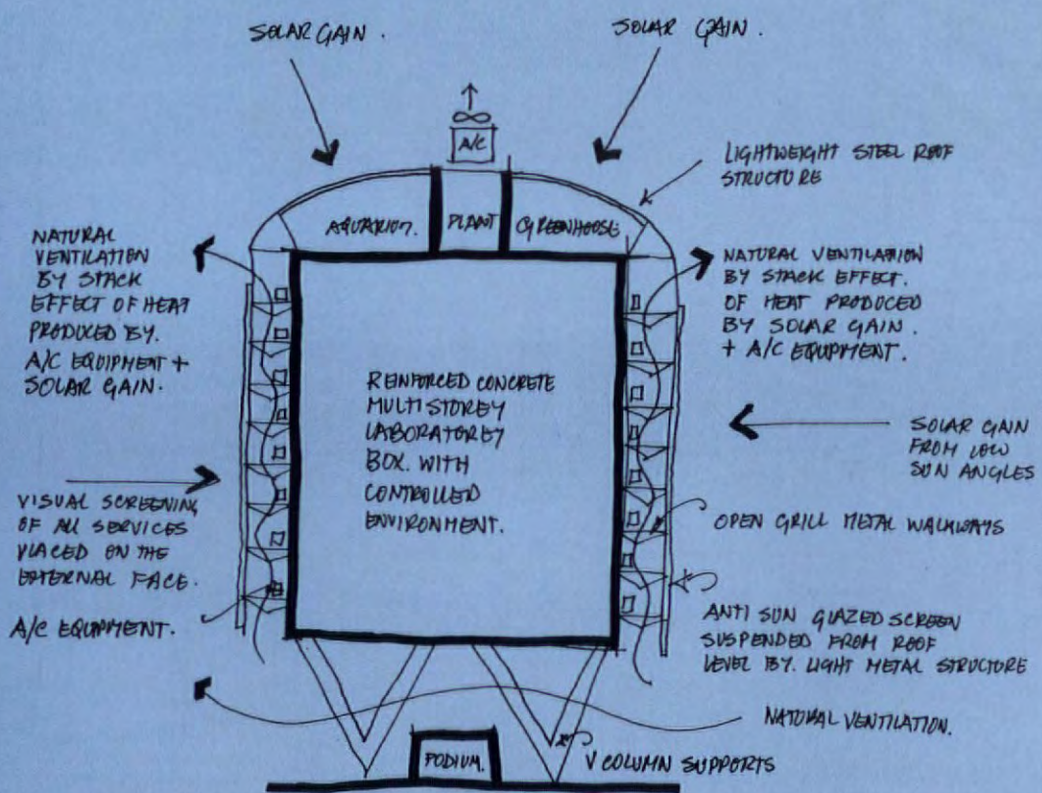


3 DIAGRAMATIC CROSS SECTION.

Bethanie Business School Pokfulam, Hong Kong

Brief:
Hong Kong University, with whom Leigh & Orange have maintained a working relationship since designing their original building in 1912, wanted to create a business school campus that would rival the world's best.

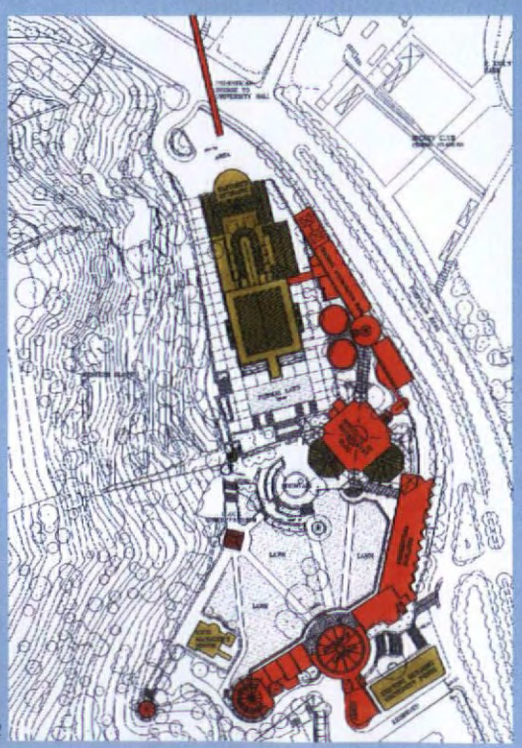
Challenge:
Leigh & Orange aimed to cultivate a rarified and academic atmosphere similar to that found in an Oxford college. A large number of existing trees required retention and magnificent sea view opportunities to the west demanded exploitation.

Solution:
The existing buildings that they had to accommodate were the old French mission infirmary known as Bethanie and the remains of what was formerly Hong Kong's only dairy farm, designed by Leigh & Orange in an earlier incarnation. They chose to construct the new buildings around the old in order to create an enclave with a central garden environmentally sheltered from a neighbouring building which was visually intrusive and a main road along the eastern edge of the site which was a major noise source. Current business school theory favours seminar rooms in-the-round with breakout rooms to accommodate smaller groups. The existing octagonal cowsheds proved ideally suited for adaptation to use as lecture theatres. The architectural language of the new buildings complements the neo-gothic of the restored Bethanie which became the centrepiece of the design. Sheltered external circulation makes it possible to wander around the whole campus under cover – an important consideration in topical climates.

Date:
Design complete (project abandoned)

Project team:
Max Benthall, Paul Clarke, Gordon McQuade, Terry Smith

1



2

1&2 Model view and site plan show new construction wrapping round the existing renovated building

Sandridge Bay Apartments
Port Melbourne, Australia

Brief:
Conversion of former sugar warehouses dating from the 1890s into luxury apartments.

Challenge:
The 1979 Port Melbourne Conservation Study drew attention to the buildings' interesting architectural character, sense of identity and importance to Port Melbourne's skyline. The fullest use had to be made of the development opportunity without endangering those qualities that gave it its unique character.

Solution:
The exteriors are finely judged to create sufficient additional storeys, new balconies and window surround infills without overwhelming the original structure. Internally a new concrete frame is provided, consisting of a central spine of precast columns and beams supporting precast planks spanning from the beams to the exterior wall.

Date:
1997

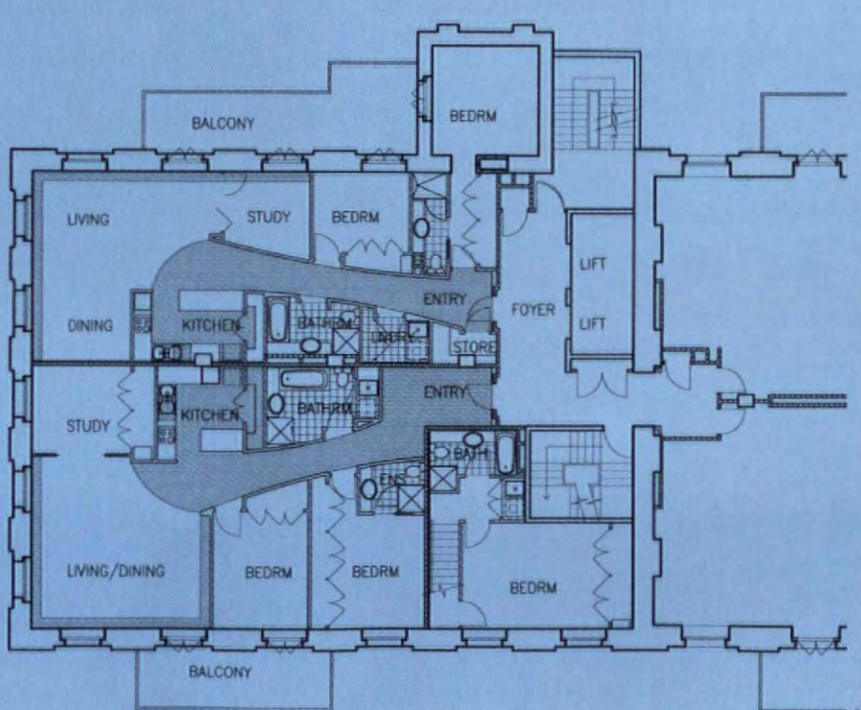
Project team:
Alfredo Marianni, Esther Mavrokki, Chris Shay, Peter Smithson, John Walters

1

1: View from the south-west. Additional accommodation and detailing have been provided while maintaining the original buildings' character

2: Fifth floor plan

3: East elevation



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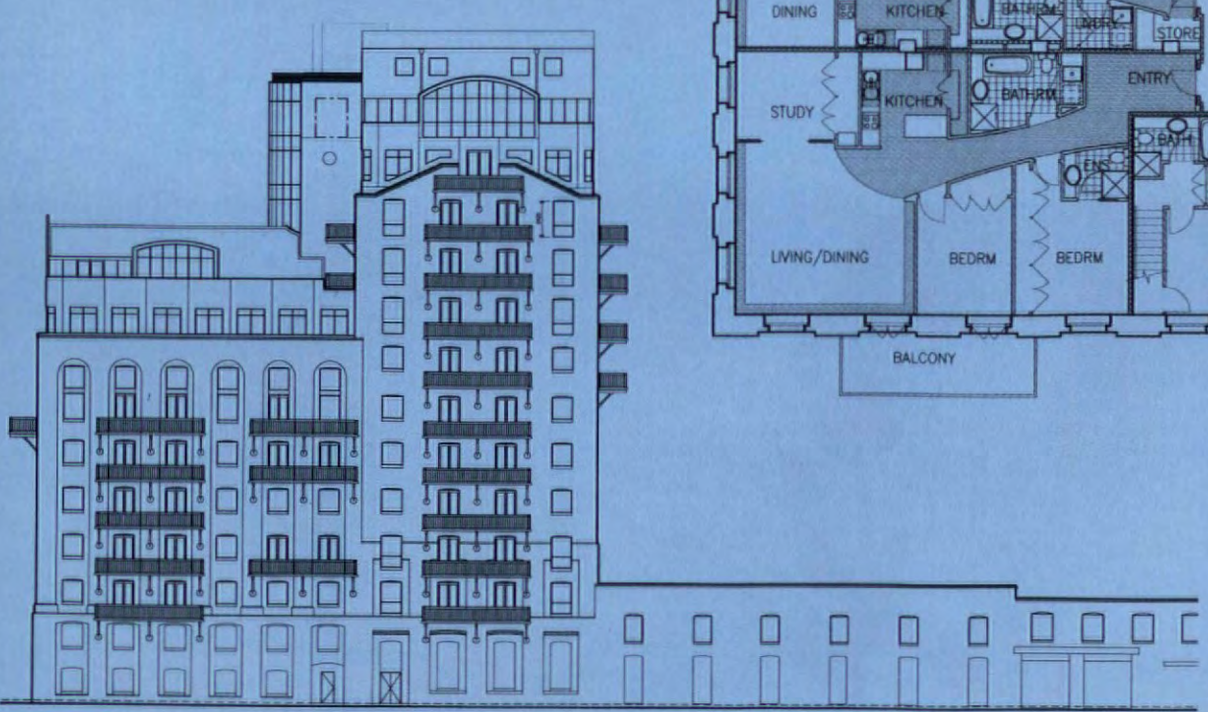

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Ritz Carlton Hotel
Central District, Hong Kong

Brief:
The Ritz Carlton chain of hotels is noted for its interiors, which are designed to evoke the atmosphere of an intimate English country house – in this case by Frank Nicholson of Boston.

Challenge:
The site lies amidst the densest concentration of work by foreign signature architects in Hong Kong. It was extremely tight – smaller than that normally considered adequate for a luxury hotel in an urban setting.

Solution:
Leigh & Orange produced an efficiently planned tower with a multistorey podium and four basement levels. Suspended ceilings are designed to be deep enough to allow pedestrian service access, to avoid disruption to the guest areas. Because the Ritz Carlton's interior design is one of its key selling points, Leigh & Orange put a degree of effort into defining precisely what kind of exterior design could best evoke these interiors. Leigh & Orange chose to use a post-Modern approach (the first in Hong Kong), with vertical bands of dark granite and a pyramidal Art Deco roof which houses the air-cooled chiller equipment. Taken together, they evoke an impression of a 1930s New York skyscraper, in striking contrast to the Hongkong Bank and Bank of China towers nearby.

Date:
1993

Project team:
James Chu, Scott Finlay, Alex Li, Gordon McQuade, Terry Smith, Hugh Zimmern

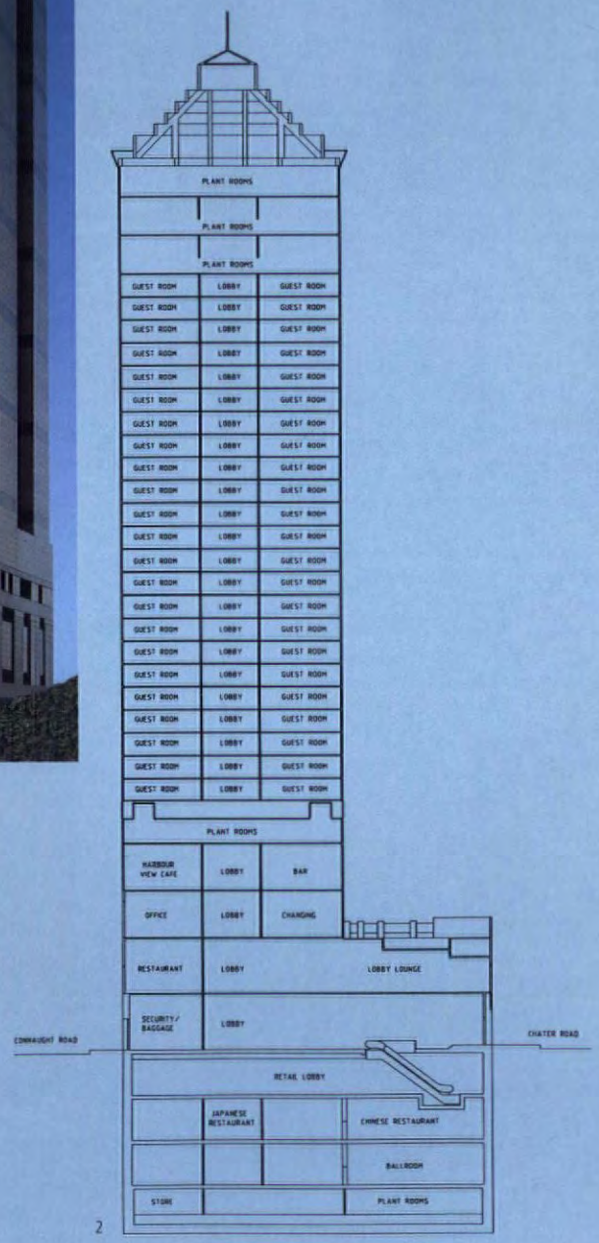
1

1: The exterior of the hotel is influenced by the Ritz Carlton chain's signature interiors

2: Section through the tower

3: Ground floor plan; podium

4: Typical floor plan; tower



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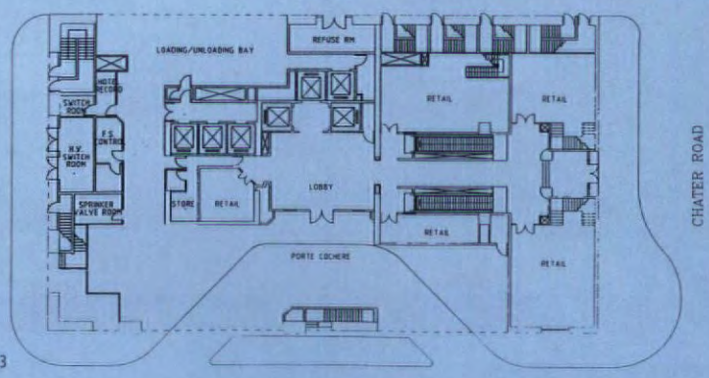

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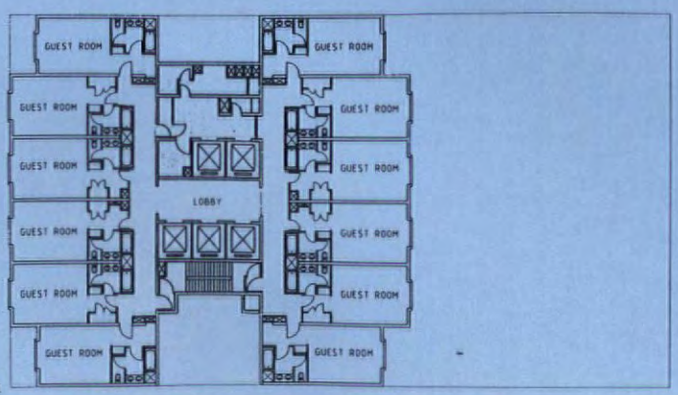


4

Strand Hotel
Yangon, Myanmar

Brief:
Built in 1910, the Strand Hotel is, with the Raffles in Singapore and the E&O in Penang, one the three great colonial hotels of East Asia. The building had been poorly maintained for many years; meanwhile eight decades of tropical rainstorms and a few minor earthquakes had taken their toll on the structure, which was crumbling in places. With the beginnings of a return to prosperity in Burma, Leigh & Orange were commissioned to carry out a major renovation.

Challenge:
Some of the greatest challenges Leigh & Orange had to face were nothing to do with the design but were the result of having to work in a chronically underdeveloped, deskilled economy. Local workmen did not know how to read drawings; even pencils were a scarce commodity. By the time Leigh & Orange became involved in a major renovation, the building itself had been the subject of numerous alterations. In conservation terms, the main issue to be settled was, to what stage in its history should it be restored?

Solution:
Leigh & Orange decided that to return the building entirely to its 1910 state was not an option. If stripped back it would have serious structural problems; in addition, at the time it was built bathrooms would have been at the front for access to drainage. Instead a sensible compromise was adopted which saw particularly poor additions built in the 1960s removed and the building brought fully up to current international standards.

Date:
1994

Project team:
Leo Barretto, Paul Clarke, David Wordsworth

1

2

3

1: The building was sensitively remodelled rather than slavishly restored

2: Dining room. The hotel's interior was brought up to the best modern international standards but retains much of the its original atmosphere

3: Night view of entrance facade

Shing Mun Valley Park Aquatic Centre
Tsuen Wan, Kowloon, Hong Kong

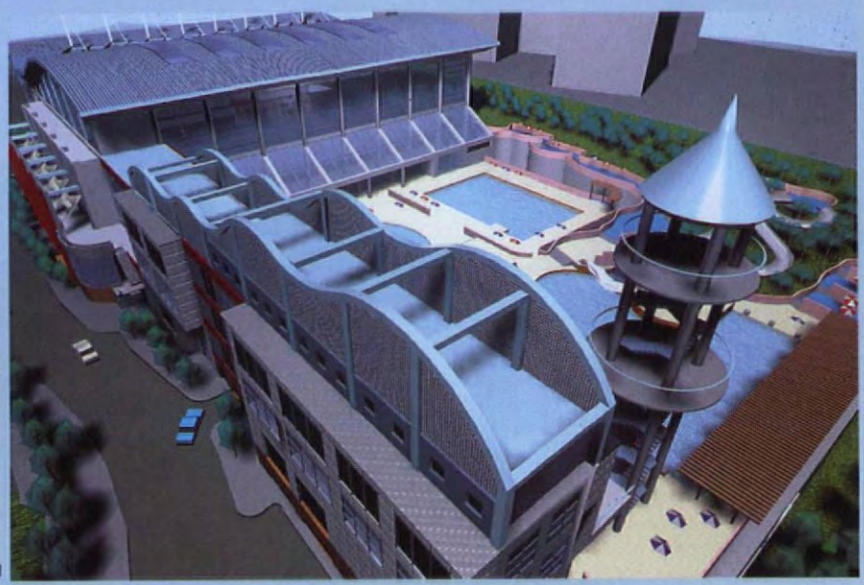
Brief:
The indoor heated pool is one of the major elements within a comprehensive regional development in Shing Mun Valley on the outskirts of Kowloon. The complex includes a full set of aquatic facilities including Olympic-sized main and diving pools and training, leisure and paddling pools.

Challenge:
The pool is the first solar-heated indoor pool in Hong Kong. It reconciles the triangular form suggested by the ideal circulation pattern within the building with a rectangular plan required by the client to meet *feng shui* considerations.

Solution:
The overall form of the building distinguishes between the orthogonal form containing the indoor pools and a landscaped recreational area whose informal landscaping bursts out of the geometric envelope. A movable pool floor and divider allows flexibility of use offering alternative facilities for shallow teaching, water polo and synchronised swimming. The design and landscaping is influenced by the forms of the traditional walled village indigenous to the New Territories. The curved roof forms convey a suitably aquatic theme.

Date:
1997

Project team:
Dominic Lam, Teresa Lam, Lawrence Lau, Felicity Williams, Clarice You



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1: Curved roof forms have suitably aquatic lines

2: Aerial view shows difference between the strict geometric form of the indoor sports pool and the informal exterior leisure facilities

3: Masts support clear-span roof over the Olympic-sized indoor pool

Kau Sai Chau Golf Course Clubhouse
Sai Kung, New Territories, Hong Kong

Brief:
Hong Kong's first public golf facility, with a course designed by Gary Player, was sponsored by the Jockey Club. Leigh & Orange, whose commission followed a tender based upon resources, fees and experience, were responsible for the clubhouse.

Challenge:
Once the rough layout for the course had been established Leigh & Orange had more scope than in most projects to determine the location of the building. In this location the building would have to permit the normal demanding set of circulation problems (such as defining the scope of spiked shoe areas) with a design that provided a sense of spaciousness and relaxation, and related to its cultural environment.

Solution:
The building is rooted in its site, yet the design possesses a certain monumentality. Leigh & Orange decided that the most appropriate model for an isolated building in this location was the traditional Chinese fort. Galleries around a courtyard frame spectacular views of the surrounding landscape.

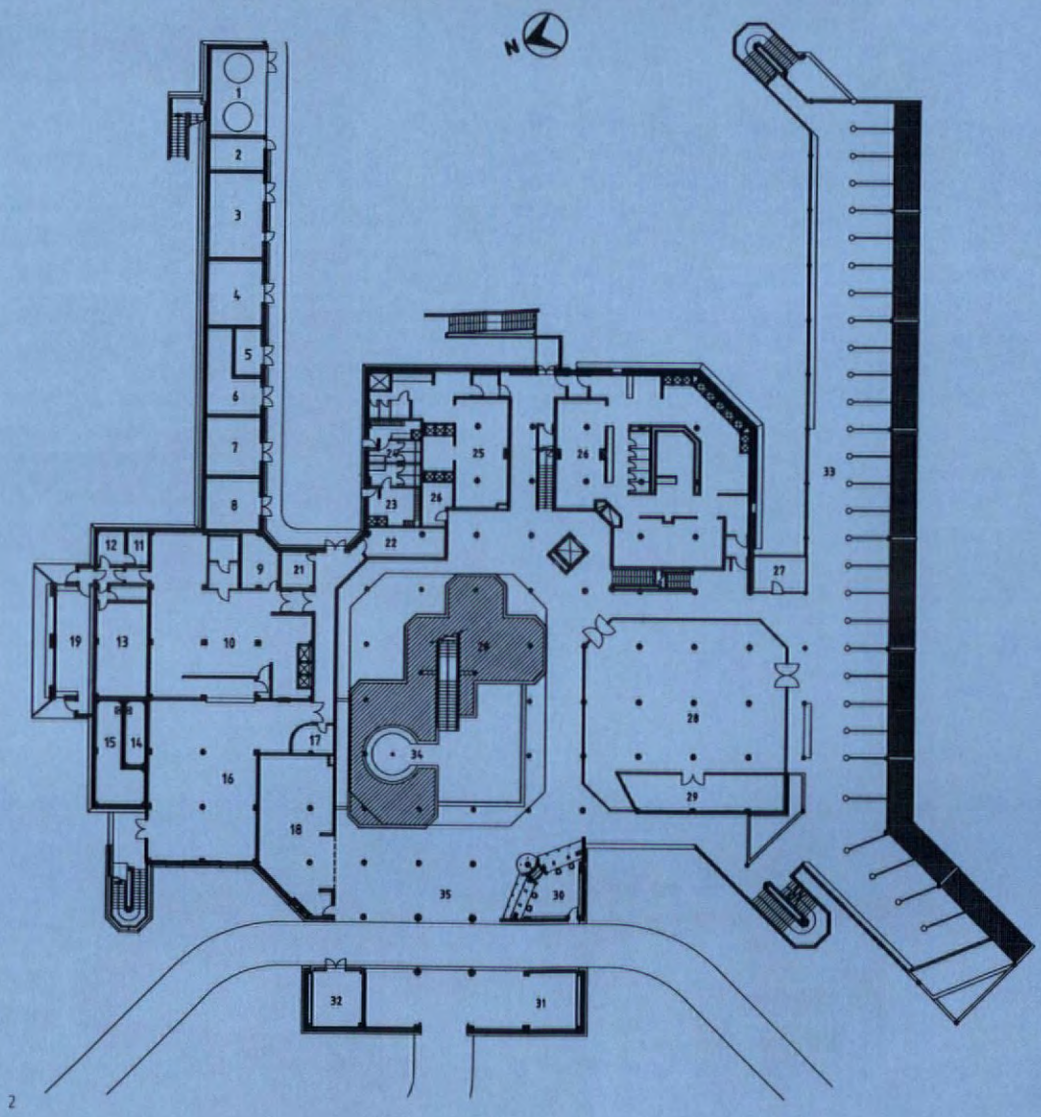
Date:
1996

Project team:
Leo Barretto, Max Benthall, Alan Li, David Stanford

1

1: Taking its form from traditional Chinese forts the building provides spectacular views of the surrounding countryside

2: Ground floor plan



2

1 Cooling tower
2 Switch room
3 Transformer room
4 Emergency generator
5 LPG Wap room
6 LP gas
7 Bar store
8 Refuse
9 Dry store
10 Hot kitchen
11 Control room
12 Control room
13 Pump room
14 36 cubic metre tank
15 94 cubic metre sprinkler tank
16 Staff canteen
17 House staff
18 Club deposit and hiring
19 Halfway house
20 Ornamental pool
21 Office
22 Laundry
23 Female staff toilet
24 Male staff toilet
25 Female changing
26 Male changing
27 Pro office
28 Pro shop
29 Pro shop storage
30 Reception
31 Trolley bay
32 Fire control panel & firefighting equipment store
33 Hitting bays
34 Bus stop
35 Entrance

Ocean Park
Brick Hill, Aberdeen, Hong Kong

Brief:
Various attractions for Hong Kong's leading theme park which was originally designed by Leigh & Orange.

Challenge:
Providing entertainment structures without resorting to kitsch or clichés. Attractions have to continue to be added in order to induce visitors to keep on returning.

Solution:
The attractions designed by Leigh & Orange are all marked by a certain wit that contrasts with the heavy-handed approach often seen at other theme parks. The Goldfish Pavilion resulted from a gift of exotic fish from the People's Republic of China. Leigh & Orange's solution eloquently addresses the problem of how best to view fish that are decorative but quite small, suggesting a cross between an art gallery and an aquarium, housed in a delightful piece of Chinoiserie modelled on pavilions from the Chin dynasty. The Butterfly House is an efficient, slightly cranked patent-glazed structure in welded steel, that just happens to look like a caterpillar when viewed from the cable car above. Meanwhile the Middle Kingdom, the most recent attraction illustrated here, provides a condensed walk through successive Chinese dynasties. It was designed to attract not only those visitors to Hong Kong who might not have enough time to see China proper, but also the local Chinese in order to ensure more visitors during mid-week. One of the issues to which Leigh & Orange paid particular attention was the matter of how to make the transition from one dynasty to another. The Aviary was designed as a stressed steel net as part of a larger landscaped complex that included a curved and brightly coloured bird theatre.

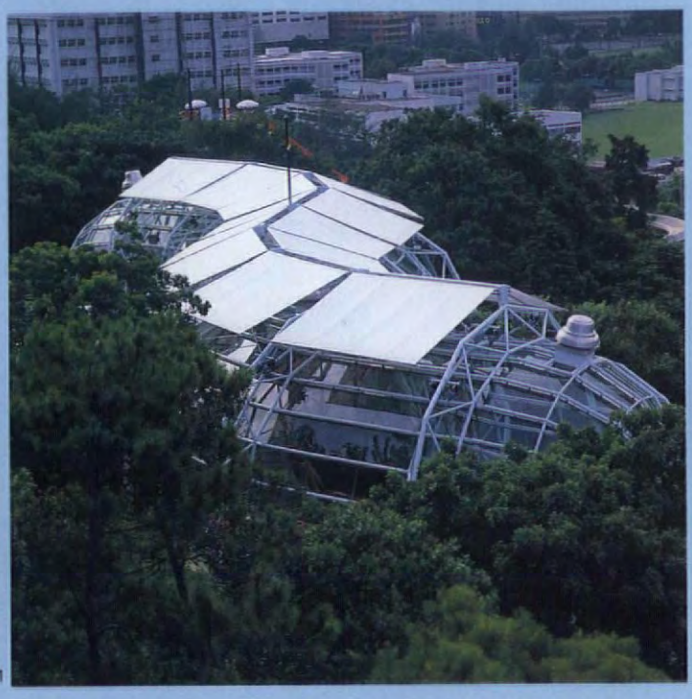
Date:
Projects completed at various times starting in 1984

Project teams:
Aviary & Bird Theatre (1986)
Dominic Lam, Hugh Zimmern

Butterfly House (1986)
Scott Findlay, Dominic Lam, Hugh Zimmern

Goldfish Pavilion (1984)
Dominic Lam, Samn Lim, Hugh Zimmern

Middle Kingdom (1989)
Dominic Lam, Kevin Ng



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1: The glazed steel structure of the Butterfly House resembles a giant caterpillar when viewed from above

2: In the Goldfish Pavilion, which was awarded the HKIA President's Prize, the fish are viewed through framed windows which look like pictures in an art gallery

3

4

3: The Middle Kingdom provides a tour of successive Chinese dynasties in microcosm

4: The Aviary and Bird Theatre

World Finance Tower
Pudong, Shanghai, People's Republic of China

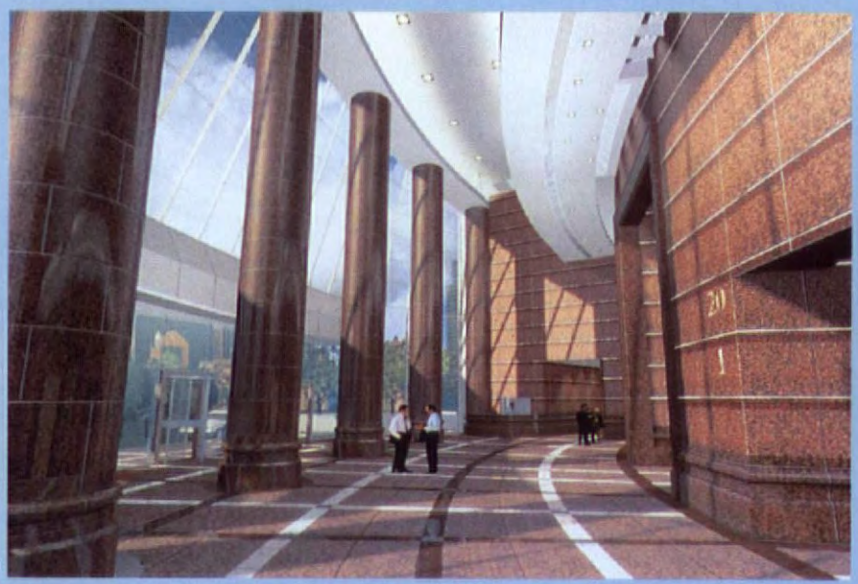
Brief:
This tower, which will be the second-tallest tower in Shanghai, symbolises the competitive commercial aspirations of the city, which is likely to rival Hong Kong in economic prominence some time in the next century.

Challenge:
The building is located as the tallest out of a group of skyscrapers nearby. Its overall envelope including podium and tower zone was determined by the masterplan. Leigh & Orange's task was somehow to ensure a distinctive form within those limits.

Solution:
The site, which lies on a corner, is slightly curved and the building – classically planned – follows suit. The effect is also to maximise views to the front. Of all the towers being built in the vicinity, the World Finance Tower is the only one to respond to Bund, Shanghai's famous late-nineteenth-century boulevard along the Huangpu River, lined with parks and neo-renaissance European architecture which the new building, in its classical symmetry, sensitively echoes.

Date:
1998

Project team:
Stephanie Chen, Dominic Lam, Sebastian Law, Hugh Zimmern



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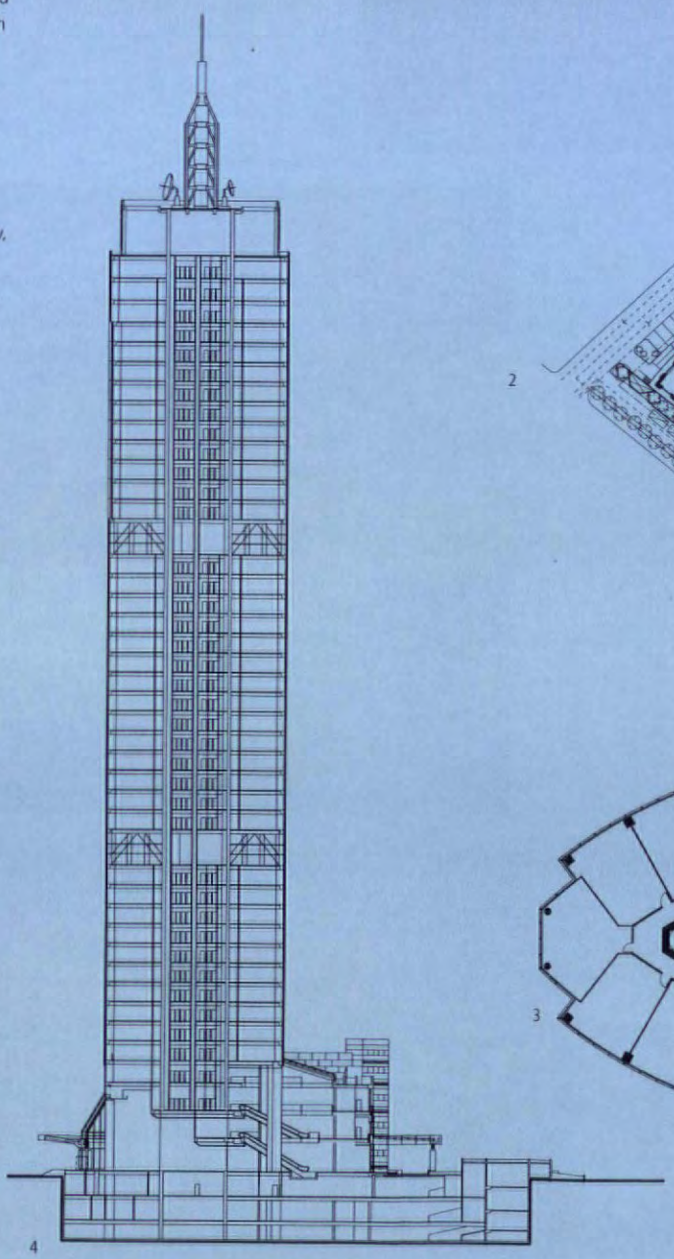

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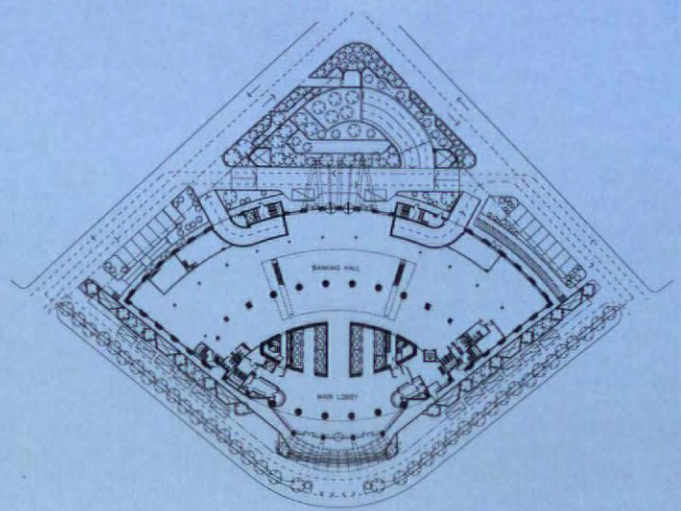

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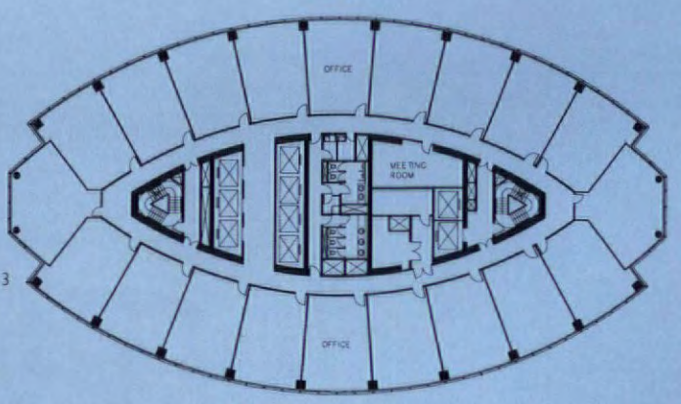


3

1: Artist's impression of the entrance lobby

2: Ground floor plan

3: Typical floor plan

4: Section

5: The building, Shanghai's second-tallest, curves to follow the lines of the site

5

Finance Central Plaza
Shanghai, People's Republic of China

Brief:
This project was the subject of a design competition for an office tower.

Challenge:
Towers in general and competition entries in particular encourage an approach that lays great emphasis on symbolism. This project was no exception.

Solution:
Leigh & Orange produced an essay in muscular high-tech architecture that was designed to symbolise quite explicitly Shanghai's economic renaissance. It promised to be the first building of its kind in the city, and created a lot of excitement.

Date:
1996

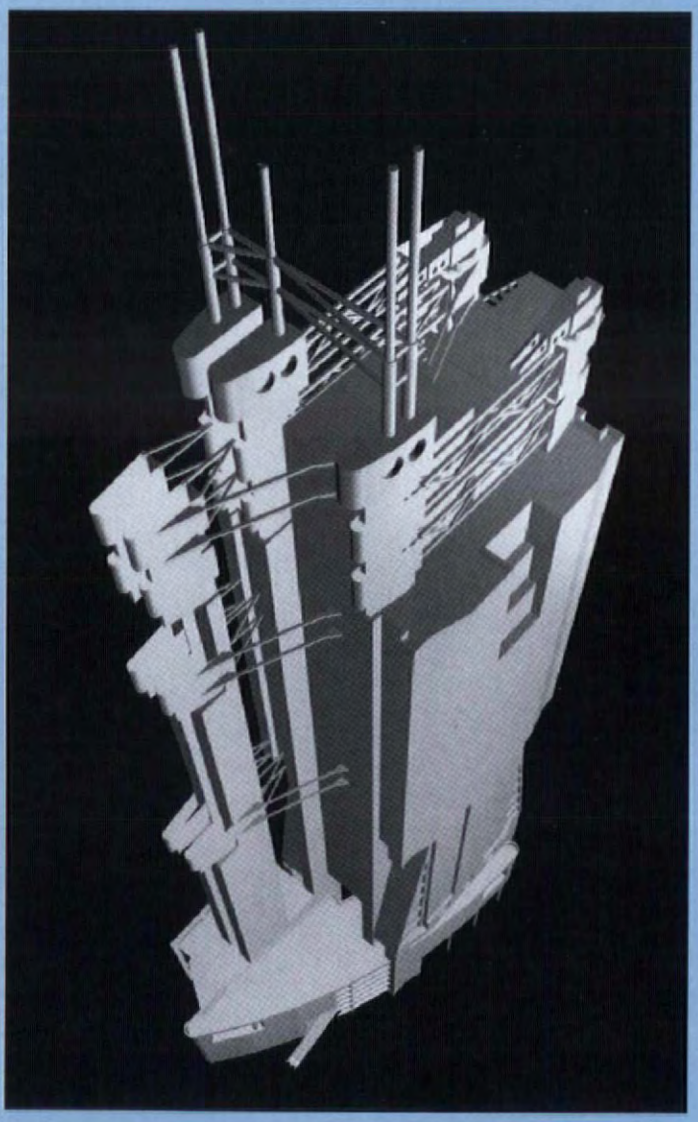
Project team:
Dominic Lam, Yu Xing

1

1: Model view of the tower from the north-east

2: Computer rendering clearly shows the detached lift tower

3: Typical floor plan



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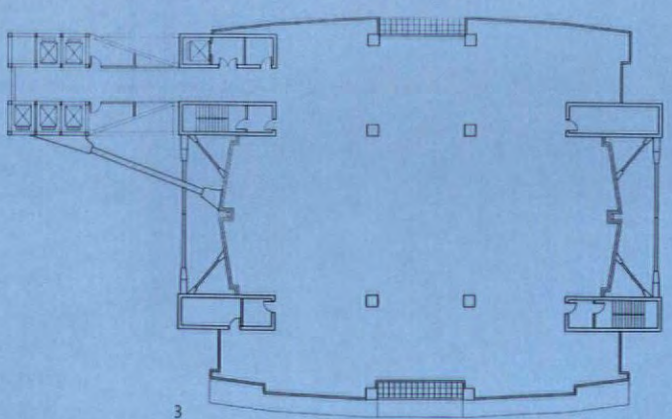

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Michelle's Restaurant, Central District, Hong Kong
Nai Lert Office, Sukhumvit, Bangkok, Thailand

Brief:
There are two interiors which demonstrate two facets of the role of interior design at Leigh & Orange, whether for creating an particular ambience in a restaurant, or for redeeming an unpromising structural configuration.

Challenge:
Michel's Restaurant was to be the first standalone restaurant in Hong Kong with a clear identity. Leigh & Orange were seeking something that was European in atmosphere without going so far as to create a pastiche. Meanwhile the lobby at Nai Lert Office was poky and deep.

Solution:
At Michel's Leigh & Orange took a conscious decision to move away from the Hong Kong convention of air conditioning and suspended ceiling. The windows are openable in winter. All furniture and fittings were designed by Leigh & Orange. At Nai Lert the space was transformed by opening up another storey at the front to create a double height space. A novel decision to express the space as two half bays rather than one single places special emphasis on the central columns, which are oval on plan to create a sense of directionality.

Date:
1992 – Nai Lert
1993 – Michelle's

Project team:
(Nai Lert only) Gordon McQuade, (both projects) Hugh Zimmern

1

2

3

1: Michelle's Restaurant has a notably modern, European atmosphere

2: Designers avoided suspended ceilings and retained openable windows

3: At Nai Lert the lobby is expressed as two half bays with new double height space

Projects for Kowloon Canton Railway Corporation New Territories, Hong Kong

Description:
KCRC, Hong Kong's "overground" railway company maintains a certain friendly rivalry with its subterranean counterpart (the Mass Transit Railway Corporation). Leigh & Orange's involvement with the KCRC began with work on the new station as part of Shatin Racecourse. This led to a term consultancy and design work on a number of station refurbishments on the existing line. Recently new noise abatement legislation has made it necessary to develop new means of screening the railway from nearby housing. Leigh & Orange has developed a series of proposed barriers including simple vertical screens and enclosures that extend three-quarters of the way around the kinematic envelope.

Leigh & Orange are also currently involved in developing stations for the new KCRC western railway line. This includes a series of new stations and obtaining planning permission for tens of millions of square feet of residential and commercial space above the various stations and transport interchanges.

Date:
1995-97

Project teams:
Lo Wu Station Refurbishment (1995)
Paul Clarke, Patrick Yue

Fanling Station Refurbishment (1996)
Paul Clarke, Anthony Haynes

Tai Po Station Refurbishment (1997)
Paul Clarke, Albert Li, Patrick Yue

Ho Man Tin Noise Mitigation (In progress)
Paul Clarke, Josephine Cheung, Scott Findlay

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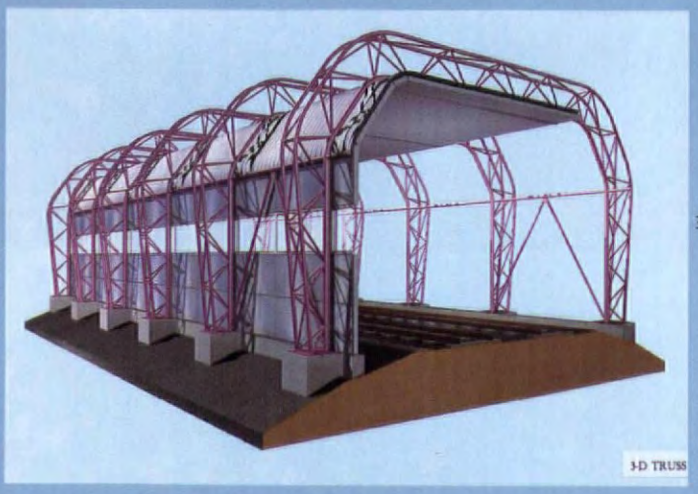

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Stations being developed for the new western section of the Kowloon Canton Railway Corporation

1: Fanling Station entrance

2: Tai Po Station

3: Lo Wun Station interior

4: Computer rendering for noise mitigation study

Silvercord Shopping Centre
Tsimshatsui, Hong Kong

Brief:
This retail plaza had been built some time ago as a podium with very dark curtain walling. It was a classic case of how not to attract passing trade, however, its location in one of Hong Kong's prime shopping zones meant that it was too good a site to be wasted.

Challenge:
The problem was how redeem the Centre as a shopping mall and also introduce food courts and a mini cinema – complete with separate entrance – without making major structural alterations.

Solution:
Leigh & Orange placed a priority on developing a degree of transparency in the building, and in how it related to the public. Wall-climber lifts were introduced as well as a series of other interventions. All of these measures had to be implemented in a piecemeal fashion, but were designed to ensure that the refurbished complex would work much better as a whole.

Date:
1996

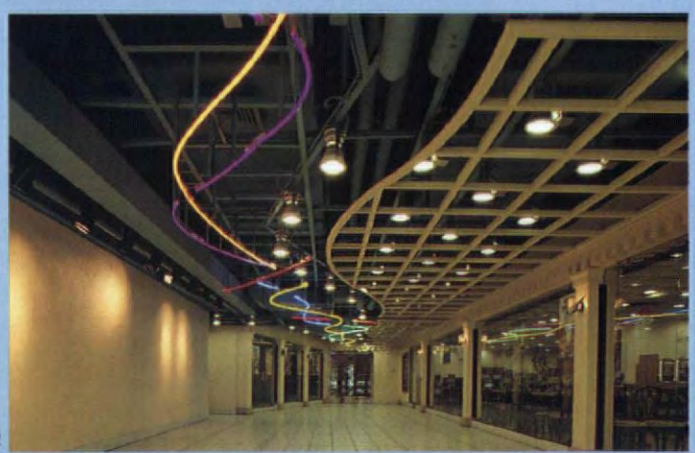
Project team:
Willie Chan, Alan Li

1

1: Refurbishment introduced a much greater degree of transparency. The new cinema entrance can be seen to the left of the main entrance

2: Decorative elements used to screen services

3: Refurbished restaurant area



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Racecourses
Hong Kong and Singapore

Description:
After working for the Jockey Club for over 50 years, Leigh & Orange can fairly lay claim to being experts in racecourse design. Their reputation has led to the firm being consulted in other countries around the world including China, Malaysia, Taiwan, Singapore and the Middle East. Kranji Racecourse in Singapore was the subject of a limited design competition, to which Leigh & Orange brought all of their accumulated expertise to bear. Architecturally the proposed fabric grandstand roof structure takes as its theme the traditional Chinese lion dance. Organisationally, it is conceived as complete leisure environment including golf course and family park

Although Happy Valley is the Jockey Club's most famous racecourse, recently expanded and refurbished by Leigh & Orange, it is the more recent Shatin, designed by Leigh & Orange, that is perhaps the most comprehensively-equipped racecourse in the world. It has its own railway station and the grandstand can house 70,000 people at peak periods. It also has air-conditioned stabling for 1,150 horses. In an effort to make fuller use of the facilities at times of the week other than race-days, the course has a full set of facilities for other sports such as squash, golf, swimming and football.

Date:
1994-1996

Project teams:
Happy Valley Stand (1996)
Leo Barretto, Paul Casey, Stewart Hill, David Keeler, David Mitchell, David Stanford

Jockey Club Box, Shatin (1996)
Leo Barretto, Robert Ferrier, David Stanford

Kranji Racecourse (Design submission)
Leo Barretto, Max Benthall

1

2

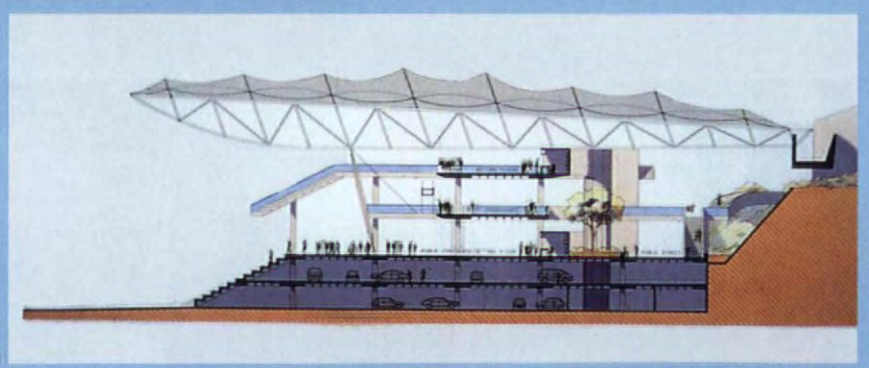
1: Shatin Racecourse, showing its proximity to the sea. The grandstand can hold 70,000 spectators

2: The Jockey Club Box at Shatin Racecourse

3: Section through grandstand at Kranji Park

4: South-west elevation at Kranji Park

5: Section through Kranji Park scheme



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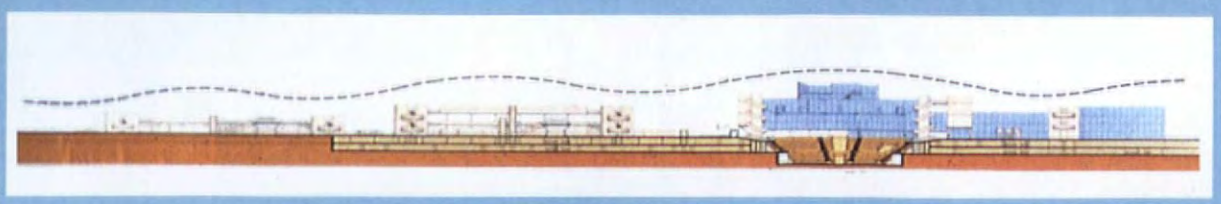


5

United Christian Hospital

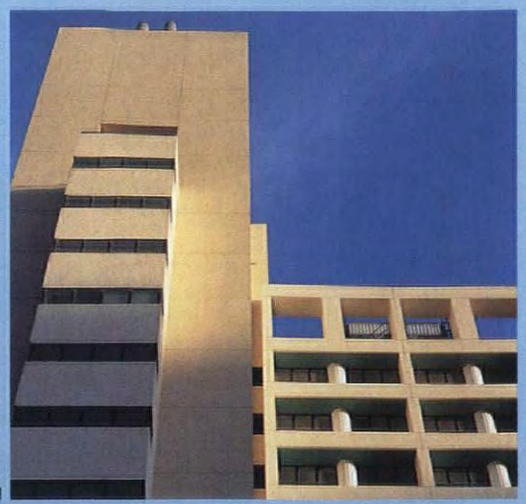
Brief:
To provide an all-services medical centre with a total of 1,400 beds as part of a comprehensive redevelopment of an existing hospital.

Challenge:
To design and construct the first and major phase of the development within a congested sloping urban site, within a tight Government cost yard stick, and yet up-dating the hospital facilities to meet modern day standards.

Solution:
The building itself comprises 12 storeys of wards over seven floors of podium. The wards are planned on a race-track principle, with all the wards facing outward, and supporting facilities in the centre. The podium takes the shape of a semi-basement, its footprint occupying the full extent of the 4,300-square-metre site, thus enabling deep planning for the general and specialist facilities, including an accident emergency department, operating suites, neo-natal care section and burns unit, as well as supporting facilities which include pathology, radiology, pharmacy, electro-medical diagnostic department, kitchen and a laundry service unit. A centrally located lift core links all the departmental facilities vertically to the wards.

Date:
1988-1994 (Phase 2 now underway)

Project team:
Willie Chan, Scott Findlay, Marcus Hing



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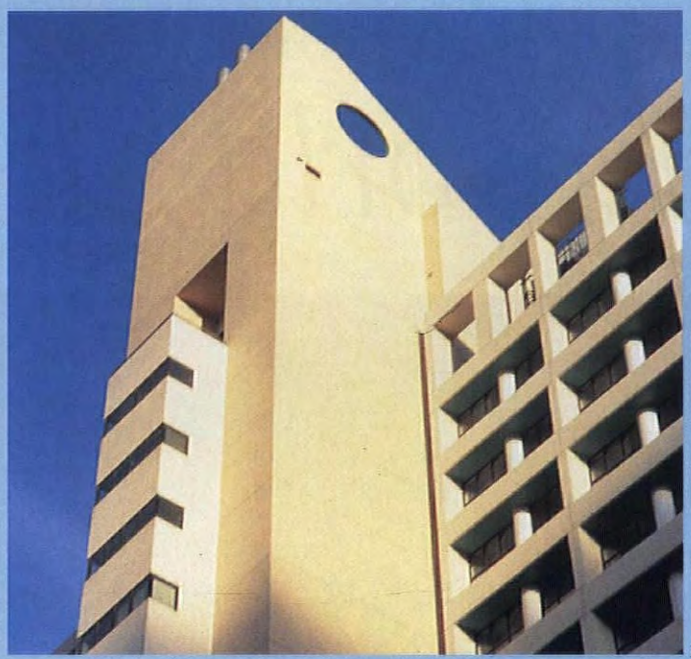

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1-3: The hospital comprises a 12-storey block of wards over seven floors of podium. The wards are planned on a race-track principle

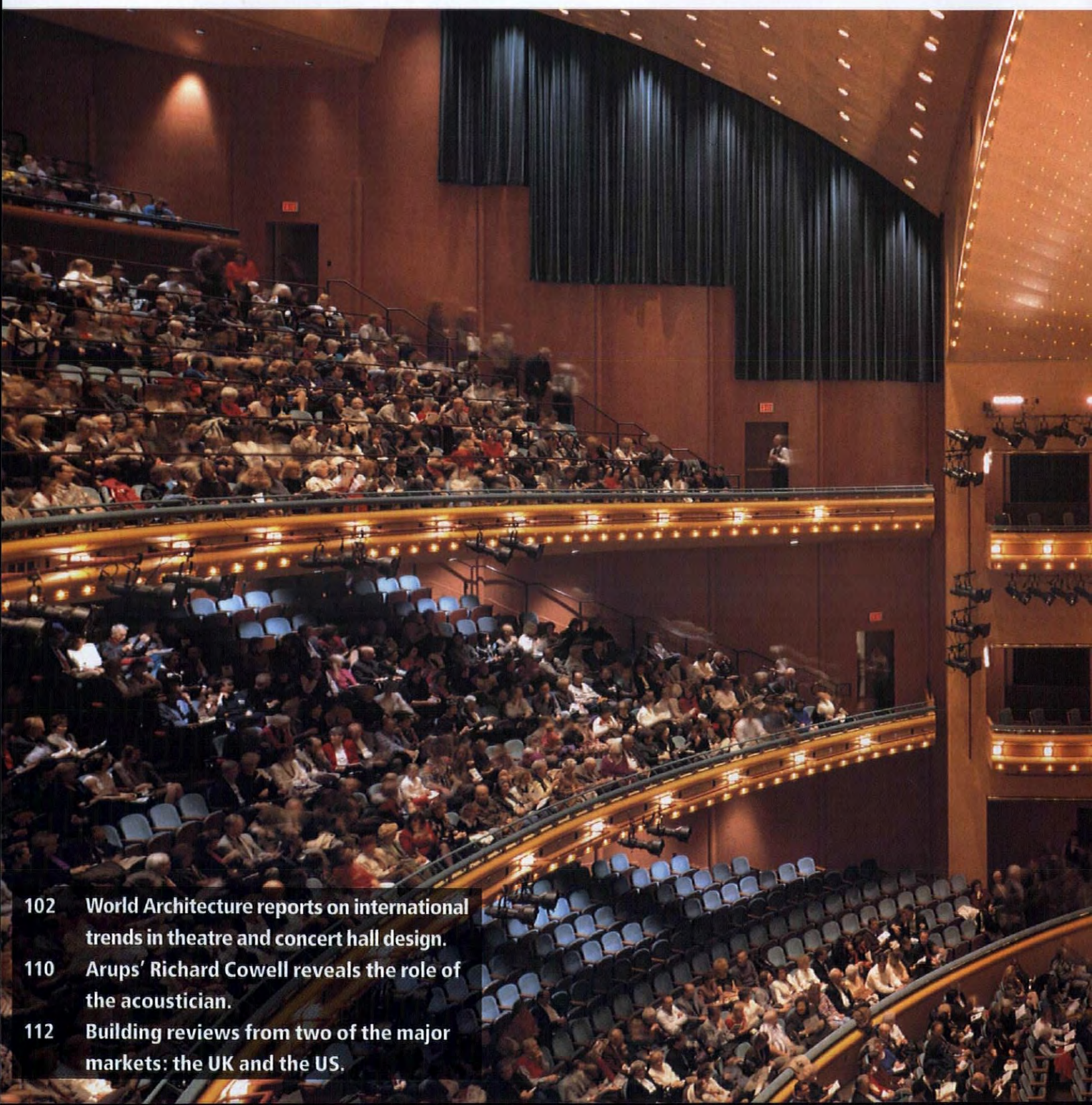
4: View of the entrance interior

3

4

Special Report – Theatres and concert halls

All the world's a stage



A generation ago any review of theatre architecture would have measured the success of a new theatre building as a social forum or as a tool for forging contemporary drama. Large commercial theatres, if built at all, were not the concern of serious architects. Iain Mackintosh, design director of the London office of Theatre Projects Consultants, demonstrates that 20 years is a long time in theatre and concert hall design.

1

Previous page
Cesar Pelli's 2,700-seat Proctor and Gamble theatre at the Aronoff Center for the Arts, Cincinnati, Ohio (1995). Photograph Jeff Goldberg/ESTO

1: View from the stage of the 1,524-seat concert hall at Moore Ruble and Yudell's California Center for the Arts, Escondido

2: The California Center for the Arts is comprised of four buildings: the concert hall; 408-seat theatre; arts centre and conference centre

Timothy Hursley

2

Timothy Hursley

Since the 1980s interest in theatre design worldwide has turned to large projects as anchors to commercial developments and/or as status symbols for resurgent western cities or the capitals of "tiger" economies. In this context theatre architecture must always be more flamboyant than the shopping mall, more fantastic than the temples of corporate culture.

The art this sort of mega theatre serves is taken as given. The show's physical requirements are measured and provided for in broadly similar style the world over. The international architect is presented with a building programme tailored by the theatre consultant. The level of technical sophistication will probably, but not always, have been matched to the budget and, if the theatre consultant is any good, a concept design of the auditorium and stage will have been offered to the architect. This was how theatres as diverse as Barton Myers' Center for the Arts in Cerritos, California – with its three storey audience towers which are earthquake proof – the two theatres at Charlotte, North Carolina by Cesar Pelli and Michael Hopkins' new Opera House at Glyndebourne, UK were designed. Such collaborations, to which the acoustician is also party, eliminates the familiar fault for many architects straying into the difficult field of auditorium design for the first time: that of too great a volume resulting from allowing sightlines and comfort to drive a cinema-like design rather than packing the audience in as tight as possible so that the energy crackles and the show succeeds.

The well briefed and well served architect can then concentrate on the building's external form and contextual quality and on the public areas which prepare the theatre goer for that special experience which is so different from either checking in to a grand hotel or genuflecting at a seat of government.

In the foyer of a major theatre the audience indulges in the almost untranslatable activity the French call *flanerie* – the public spectacle of people sauntering before the gaze of others. Then, once in the auditorium, the magic takes over if the architect has achieved the whole purpose of auditorium architecture which is the channelling of energy from the performer to the audience and back again. It is of course this last element, the reciprocity of the active audience, which distinguishes live theatre from cinema with its passive spectators or television with its couch potatoes.

"Architecture becomes the stage on which society can act out its empathetic adjustments of an inherited past to the continuously uncertain present" Robert Venturi (1966)

Is big necessarily better?

The channelling of energy is at the centre of all theatre architecture whatever culture and in whatever form of building. But today worldwide interest in the 2,000-plus seat theatre is resulting in stylistic similarities that blur cultural differences. The 2,000 audience members in such theatres will not know if their seats have been designed or manufactured in Spain, Japan or America, whether the stage machinery and lighting is British, Belgian or German, even whether they are sitting in middle town USA or Tokyo. They will probably be watching cloned versions of the same production of Les Misérables, a show composed by a Frenchman, premiered by the UK's Royal Shakespeare Company and then franchised across the globe. There is a real danger of a deadly sense of sameness. Are both shows and theatres simply the artistic equivalent of the Boeing 747 and the air terminal hotel?

We have certainly been here before. In the 1920s the world's first international building type, the "movie theatre" was created in Hollywood meaning that the same product could be consumed from Tashkent, Uzbekistan to Toledo, US. But the stock market crash of 1929 brought to an end 15 years of frantic cosntruction activity. Of scores of thousands of these movie palaces built across the world hardly five percent survive today. The art of cinema is no longer displayed in movie palaces but rather in anonymous multiplexes whose character is confined to the facades and foyers.

Will the same fate of obsolescence happen to the big flagship theatres now being built? Will the wider public, far beyond that of New York, London or Paris where the theatres originating these shows are much smaller, lose interest in watching mega musicals or grand operas in vast theatres where the performer is no bigger than the thumb nail of the distant spectator's outstretched hand?

US takes the lead in a search for an alternative

The answer in the long term is probably that it will, and that soon in the next century we will find we have quite enough large theatres worldwide. Theatre architecture will then revert to the exploration of new forms and of social engineering as it did in the middle of the century. But there are signs of change.

Today canny cities ensure that behind their new big theatre is a smaller flexible space which attracts actors and artists to create their own work rather than reproduce the commercial hits of others. At the Cesar Pelli-designed Aronoff Center for the Arts, in Cincinnati, Ohio the new 440-seat Jarson-Kaplan theatre sits side-by-side with the 2,700-seat Proctor and Gamble theatre – the Center also houses the 150-seat Fifth Third Bank Theatre. The same is so for the new Lowry Centre at Salford in England which has been funded by the National Lottery and starts construction later this year. Behind a 1,650-seat Lyric Theatre designed by Michael Wilford and Partners is a 450-seat flexible space. Only in Singapore have the three smaller theatres, in styles which reflected Southeast Asian antecedents as well as both classical Chinese and Western European traditions, been cut in the interests of economy leaving the stately 2,000-seat theatre and 1,800-seat pure concert hall without the third more future orientated element.

But in the mid-term, in the time that it takes for another 50 of these prestigious 2,000-seat theatres to be built, the business of theatre architecture will not change for states and cities that can afford the US$100 million to US$500 million price tag. Advances in both acoustic design for the unassisted voice and sound technology for the musicals will attract audiences to the touring hit shows from Broadway and London as well as to large-scale ›

From first base to finished product

Theatre and concert hall cost considerations in the US

Donnell Consultants Incorporated (DCI), Tampa, Florida-based theatre cost management and client representative consultants were founded in 1986 by Stewart Donnell. They are the only construction cost consultants in the US to specialise in concert hall, theatre, opera house and performing arts centre projects. They provide a rough overview of cost considerations and typical cost breakdowns in North American theatres and concert halls.

Cost issues to consider

Brief content
Net to gross area efficiencies
Gross floor area
Seat count
Seating configuration
Noise criteria (NC) levels in critical rooms
Performance equipment scope
Performance equipment accommodations
Exterior architectural quality and massing
Interior architectural qualities
Extent of public lobby space
Extent and types of support spaces
Construction procurement methodology
Design team's experience

Design elements to consider in budget preparation

Foundations
Structural frame
Exterior skin
Interior partitions and doors
Vertical and horizontal movement
Interior finishes
Fixtures and equipment
Electrical systems
Plumbing, fire protection, heating, ventilation and a/c
General contractor's overhead and profit
(performance equipment, owner's FF&E, site work and ancillary construction are separate from "building" cost)

Costs for a Cesar Pelli-designed, 2,200-seat concert hall (A) and a 2,480-seat opera/ballet (B) theatre in the state of Florida (date of completion 2001)

A Concert Hall

	Cost per US$ thousand	%
1 General requirements	4,868	9.63
2 Concrete	1,665	3.29
3 Masonry	4,377	8.66
4 Steelwork	6,822	13.50
5 Carpentry	60	0.12
6 Roofing	916	1.81
7 Doors/Windows	3,195	6.32
8 Finishes	5,935	11.74
9 Specialities	2,550	5.05
10 Equipment	5,396	10.68
11 Special conditions	2,474	4.90
12 Conveying	1,127	2.23
13 Plumbing/HVAC	6,726	13.31
14 Electrical	4,429	8.76
Totals	**US$50,540**	**100.00%**

B Opera/Ballet theatre

	Cost per US$ thousand	%
1 General requirements	6,852	9.48
2 Concrete	2,413	3.34
3 Masonry	6,488	8.98
4 Steelwork	11,475	15.89
5 Carpentry	66	0.09
6 Roofing	1,237	1.71
7 Doors/Windows	4,387	6.08
8 Finishes	5,518	7.64
9 Specialities	3,606	4.99
10 Equipment	7,393	10.24
11 Special conditions	4,625	6.42
12 Conveying	1,511	2.09
13 Plumbing/HVAC	9,507	13.17
14 Electrical	7,132	9.88
Totals	**US$72,210**	**100.00%**

Costs for school of music, 350-seat recital hall, 130-seat organ hall, 150-seat lecture hall, two rehearsal halls and faculty teaching studios State of North Carolina university.

	Cost per US$ thousand	%
1 General requirements	1,724	9.59
2 Concrete	2,678	14.90
3 Masonry	1,787	9.94
4 Steelwork	545	3.03
5 Carpentry	1,317	7.33
6 Roofing	540	3.00
7 Doors/Windows	920	5.12
8 Finishes	1,925	10.82
9 Specialities	407	2.26
10 Equipment	455	2.53
11 Special conditions	58	0.32
12 Conveying	99	0.55
13 Plumbing/HVAC	3,397	18.90
14 Electrical	2,104	11.70
Totals	**US$17,976**	**100.00%**

Costs for university performing arts facility in the State of Maryland, comprising a concert hall, recital hall, multi-purpose hall, dance theatre, corresponding rehearsal spaces and teaching studios with a total seating capacity of 2,500.

	Cost per US$ thousand	%
1 General requirements	10,114	13.50
2 Concrete	6,402	8.54
3 Masonry	9,922	13.24
4 Steelwork	9,274	12.38
5 Carpentry	312	0.42
6 Roofing	2,453	3.27
7 Doors/Windows	3,764	5.02
8 Finishes	6,760	9.02
9 Specialities	1,427	1.90
10 Equipment	3,589	4.79
11 Special conditions	19	0.02
12 Conveying	625	0.83
13 Plumbing/HVAC	10,373	13.84
14 Electrical	9,916	13.23
Totals	**US$74,950**	**100.00%**

opera, ballet and dance. Stage lighting becomes brighter so as to enhance the actor.

Stage engineering can adjust the width of the proscenium or the size of the orchestra pit at the touch of a button. State-of-the-art technology facilitates the drama of the theatre spectacle, which attracts large audiences. The entrance money paid will never recoup the costs of the capital investment (which is why there is hardly ever any commercial theatre building anywhere) but success will make the producer of the show happy and the city or business interests, who made the capital investment on a not-for-profit basis, regard the money well spent for the prestige brought to their city.

THE ASIAN EXAMPLE

In Southeast Asia there are more capital cities which will follow Kuala Lumpur and Singapore where national arts centres are already under construction. In Jakarta the Teatr Besar, with 1,600 seats, is in detailed design by Indonesian architects Atelier 6 assisted by international consultants. The client here is the City, but the Government may soon follow suite with an Indonesian National Arts Centre which will almost certainly involve an international competition. In mainland China large cities are already commissioning western style opera houses as evidence of their new cultural freedom and of China's internationalism. In Nanjing the winner of a competition for an opera house is about to be announced at the time of going to press, while elsewhere much is being planned.

Japan

Japan seems closed to the international theatre architect. Western-style theatres and concert halls abound but all are by Japanese architects who are able not only to serve indigenous theatre forms such as Noh, Kabuki and Bunraku but also assimilate western influences. At Togamura Arata Isozaki included a lakeside Greek amphitheatre in his ravishing village of performance spaces otherwise dedicated to intimate Japanese traditions: a western influence but no western architect. Indeed Japanese architects seem to be the first foreigners to travel the other way and penetrate the vast American market for performance art buildings which no European has succeeded in doing in over 200 years.

India

India on the other hand has always been open to architects from overseas. British theatre architects built there during the Raj. In Delhi in 1986 an international competition was held for the three performance space Indira Gandhi National Centre for the Arts. American architect Ralph Lerner won but sadly detailed design is yet to start.

Current theatre and concert hall projects in Australia and Asia

AUSTRALIA

Project **Queensland Performing Arts Centre**
Location **Queensland**
Project type **700-seat theatre**
Client **Government**
Architect **Robin Gibson and Partners**
Theatre consultant **In house**
Acoustic consultant **Peter Knowland and Ass.**
Completion date **1998**

Project **Mandurah Theatre**
Location **Perth, Western Australia**
Project type **Regional theatre**
Client **Municipality**
Architect **Hames Sharley**
Theatre consultant **Toussaint Rayner**
Acoustic consultant **Professor Laurie Hegvold**
Completion date **1997**

Project **Canberra Theatre Centre**
Location **Canberra**
Project type **New playhouse**
Client **Government**
Architect **Hassell Pty Ltd**
Theatre consultant **Entertech**
Acoustics consultant **Robert Fitzell Acoustics**
Completion date **1998**

Project **Walsh Bay Theatre**
Location **Sydney**
Project type **Drama theatre**
Client **N/A**
Architect **Peddle Thorpe and Waller**
Theatre consultant **Entertech**
Acoustics consultant **Arup Acoustics**
Completion date **2000**

SINGAPORE

Project **The Esplanade – Theatres on the Bay**
Location **Singapore**
Project type **Performing Arts Centre**
Client **Government of Singapore**
Architect **Michael Wilford and Partners**
Theatre consultant **Theatre Projects Consultants (TPC)**
Acoustic consultant **Artec**
Completion date **2001**

Project **National University of Singapore (NUS)**
Location **Singapore**
Project type **Arts Centre**
Client **NUS**
Architect **RSP Architects**
Theatre consultant **TPC**
Acoustic consultant **Acoustic Dimensions**
Completion date **2000**

Project **Singapore Repertory Theatre**
Location **Singapore**
Project type **Conversion of shop house to small theatre**
Client **Theatre company**
Architect **N/A**
Theatre consultant **TPC**
Acoustic consultant **Acoustic Dimensions**
Completion date **1999**

Project **Nanyang Girls School**
Location **Singapore**
Project type **Educational facility**
Client **Nanyang Girls School**
Architect **Ong & Ong Architects**
Theatre consultant **TPC**
Acoustic consultant **Acoustic Dimensions**
Completion date **1999**

HONG KONG

Project **Yuen Long Civic Theatre**
Location **New Territories Hong Kong**
Project type **Theatre – arts centre**
Client **Government**
Architect **Architectural Services Dept. Hong Kong**
Theatre consultant **Carr & Angier**
Acoustic consultant **Vipac Engineers**
Completion date **1998**

Project **Kwai Tsing Theatre**
Location **Hong Kong**
Project type **Theatre**
Client **Government**
Architect **Architectural Services Dept. Hong Kong**
Theatre consultant **Technical Planning International**
Acoustic consultant **Vipac Engineers**
Completion date **1998**

MALAYSIA

Project **Petronas Concert Hall**
Location **Kuala Lumpur**
Project type **Concert hall**
Client **Developer**
Architect **Cesar Pelli**
Theatre consultant **TPC**
Acoustic consultant **Kirkegaard and Associates**
Completion date **1998**

Project **Old Theatre**
Location **Kuala Lumpur**
Project type **Restoration of theatre**
Client **City of Kuala Lumpur**
Architect **City of Kuala Lumpur**
Theatre consultant **TPC**
Acoustic consultant **TPC**
Completion date **1999**

INDONESIA

Project **Teater Besar**
Location **Jakarta**
Project type **Arts centre**
Client **City of Jakarta**
Architect **Atelier 6, Indonesia**
Theatre consultant **TPC**
Acoustic consultant **Acoustic Dimensions**
Completion date **2000**

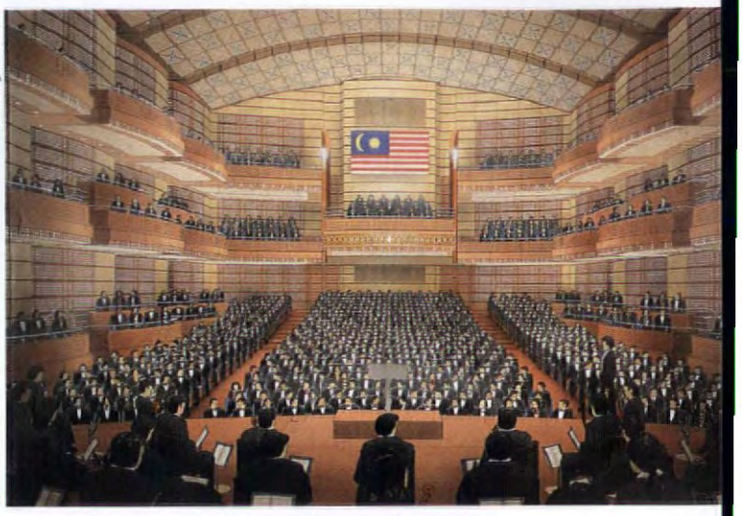
CHINA

Project **Jiangsu Opera House**
Location **Jiangsu Province**
Project type **Performing arts centre**
Client **Province of Jiangsu**
Architect **Competition in progress**
Theatre consultant **Competition in progress**
Acoustic consultant **Competition in progress**
Completion date **2001**

Source: Theatre Projects Consultants


©Technical Art

1


Rendering: Lee Dunette

2

The Middle East and Africa

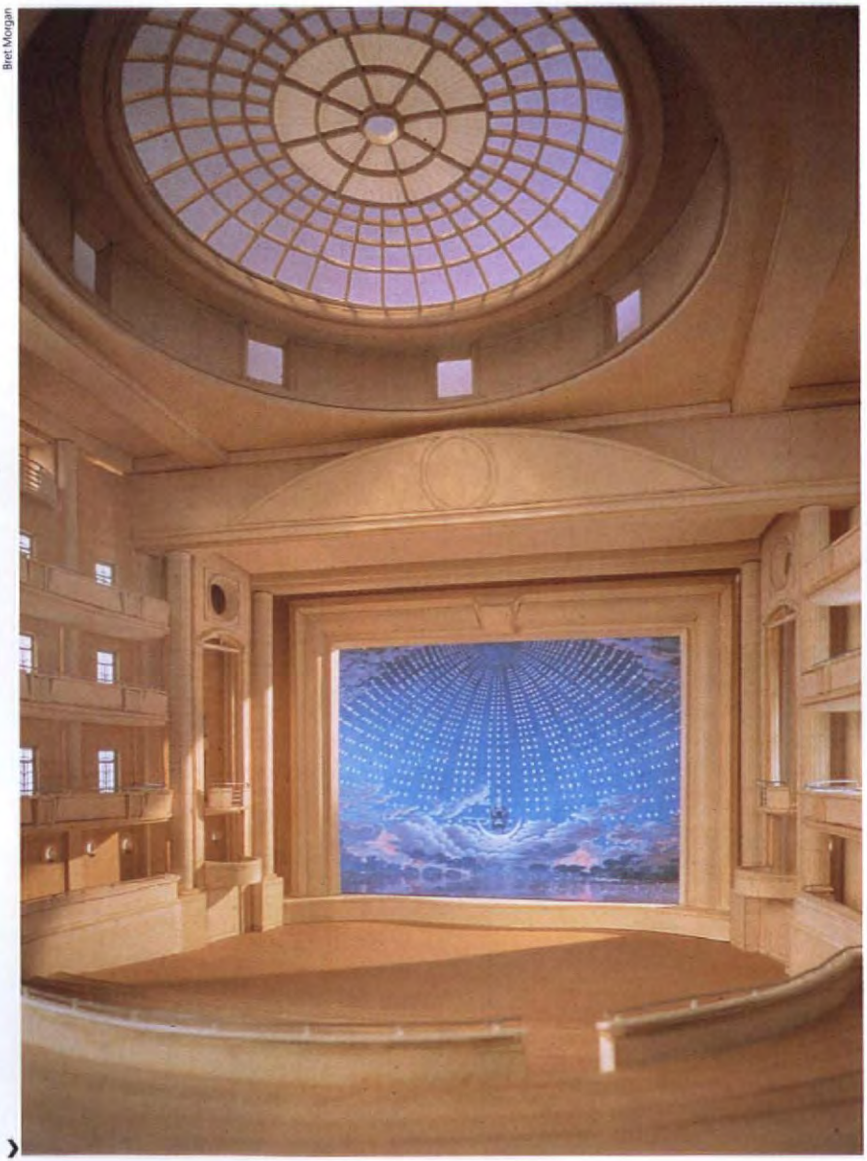
In the Middle East the Gulf States have all the theatres they need while in Iran a return to the time when over 30 arts centre were in design immediately before the fall of the Shah is unlikely. In South Africa, which has a wonderful indigenous theatre of its own, there are now other political priorities while in the rest of Africa there is little money for what most would regard as a luxury.

SOUTH AMERICA

South America is littered with many marvellous nineteenth century opera houses. Decline in wealth and the Spanish retreat from colonialism has left many of these great theatres intact while in North America the nineteenth century theatres were almost always swept away in the early part of this century and replaced by the new. Now the *zeitgeist* is for reinterpreting the past there are rich opportunities in South and Central America for restoring old theatres and reclothing them in a contemporary style.

The best are already being refurbished, like the 1908 Teatro Colon of Buenos Aires. In the 1970s some entirely new theatres were created, like the Centro Cultural Tereso Carreno in Caracas, Venezuela with 2,700 seats set within a huge angular brutalist structure. But architectural tastes have changed since then and the most interesting of the new projects today is the creation of a neo-baroque 2,400-seat opera house in São Paulo, Brazil, to supplement the smaller Teatro Municipal, which even when 1,700 are crammed in, cannot maintain a place in the first league of international opera houses.

The architect for the new house is American Charles Young working with acoustician Chris Jaffe and Theatre Projects Consultants' North American office. If South America, rich in both natural resources and in theatrical tradition, makes the economic advances many predict these will be exciting opportunities for the theatre architect in a culture that has always been open to international influences.


Bret Morgan

3

1: The New National Theatre of Japn, Tokyo, one of a new breed of western-style theatres springing up in the country

2: Rendering of Cesar Pelli's Dewan Filharmonik Petronas Hall (1998), a 28,000-square-foot theatre located at the heart of the podium levels of the Petronas Towers, Kuala Lumpur

3: Model view of Charles Young's interior for the new 2,400-seat supplement to São Paulo's 1,700 seat Teatro Municipal, Brazil. Young's Novo Teatro, located in the Jaguar district of the city is to be completed by 2000

›EUROPE

For clarity Europe should be divided in three: Eastern Europe from the Czech Republic to the Urals; Western Europe excluding Germany, and re-united Germany which stands as a case on its own, taking over from Italy at the beginning of this century as the country which insists that every town should have its own theatre.

Eastern Europe

Eastern Europe is another area for the next century. The great old theatres such as the Bolshoi in Moscow are falling apart. Elsewhere the huge brutalist palaces of culture are universally disliked and associated with socialism. In Presov, Slovakia, an almost new 600-seat single tier theatre where the proscenium was 30 metre wide but reducible to 20 metres, an absurdity better suited to parades than plays (the 2000 seat Covent Garden Opera House has a proscenium of only 12.3 metres). In Bratislava, the capital of Slovakia, the socialist inspired National Theatre and Opera House will open in 1999 but after that we can expect an entirely new generation of more vital performances spaces plus restoration of the nineteenth century masterpieces by such as those of Viennese architects Fellner and Helmer who built over 80 theatres from Odessa to Zurich. Today it is a question of money which can be speeded only if Western governments offer the services of their national architects and engineers at subsidised rates, something which is not out of the question.

Germany

Germany is the great puzzle. In the 1950s and 1960s the rebuilding of their mostly modest sized but well equipped opera houses and theatres was a priority when they and other countries still had ration books. A few were restorations but most were new buildings which are now 40 years old and, with few exceptions like Alvar Aalto's posthumous Essen Opera House, are unlikely to be regarded as sacrosanct now that tastes in both theatre production and architecture have changed so much. German governments, both national and those of the *lands*, are internationalist. Competitions have recently been held in Potsdam and Bremen. Expect many more in the next decade.

Western Europe

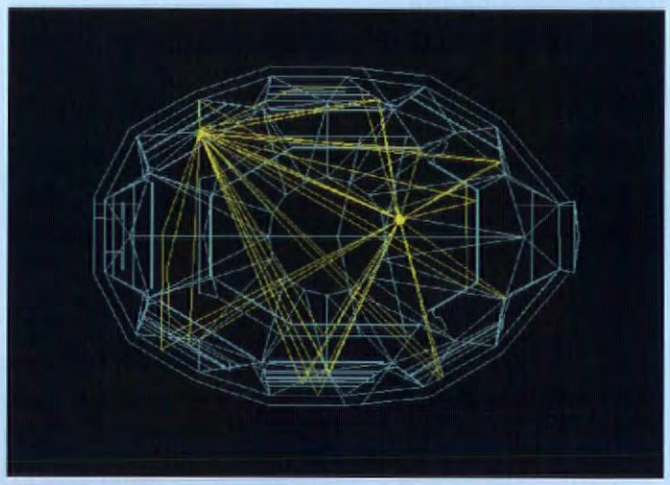
The majority of the remaining European countries observe the European Community requirements that all projects with public money have to be advertised in the European Journal whether architect selection is by open competition, limited competition or competitive interview. But some countries like France make the pre-registration of architects so complex as to deter all but the most determined who soon discover that theatre in France is inward looking. In contrast in

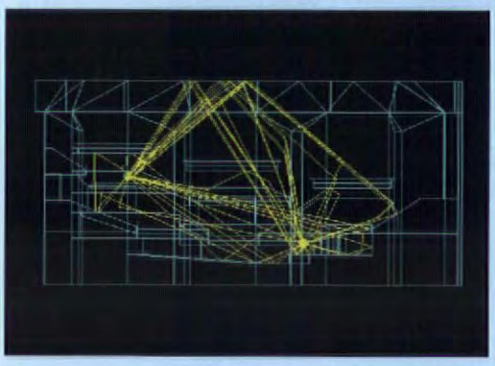
Istanbul Kültür ve Kongre Merkezi, Turkey

by Robert Essert of Arup Acoustics

A three-dimensional model of the hall is used as the basis for acoustical analysis, as the acoustics of a space depend on its geometry and surface characteristics. The computer determines the sound reflection paths from all the surfaces to the listeners; these arrive several milliseconds after the direct sound, and extend to several seconds.

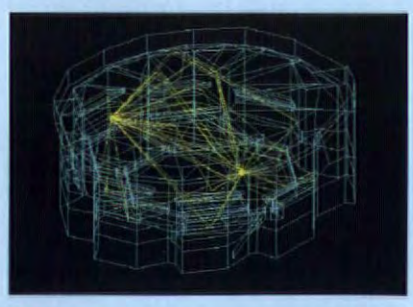
The early sound reflection paths are shown in yellow, against a wire frame model of the hall in blue. Sound paths are traced from a particular source position (the performer) of a particular listener destination. Analysis of space, time and frequency follow from the model output, which is generated for several representative source and receiver positions. Sound rendering, or "auralisation" is generated for listening to speech and music through the virtual hall.

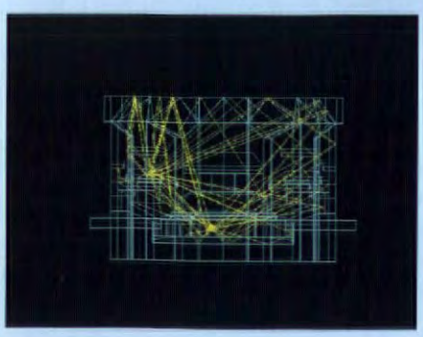


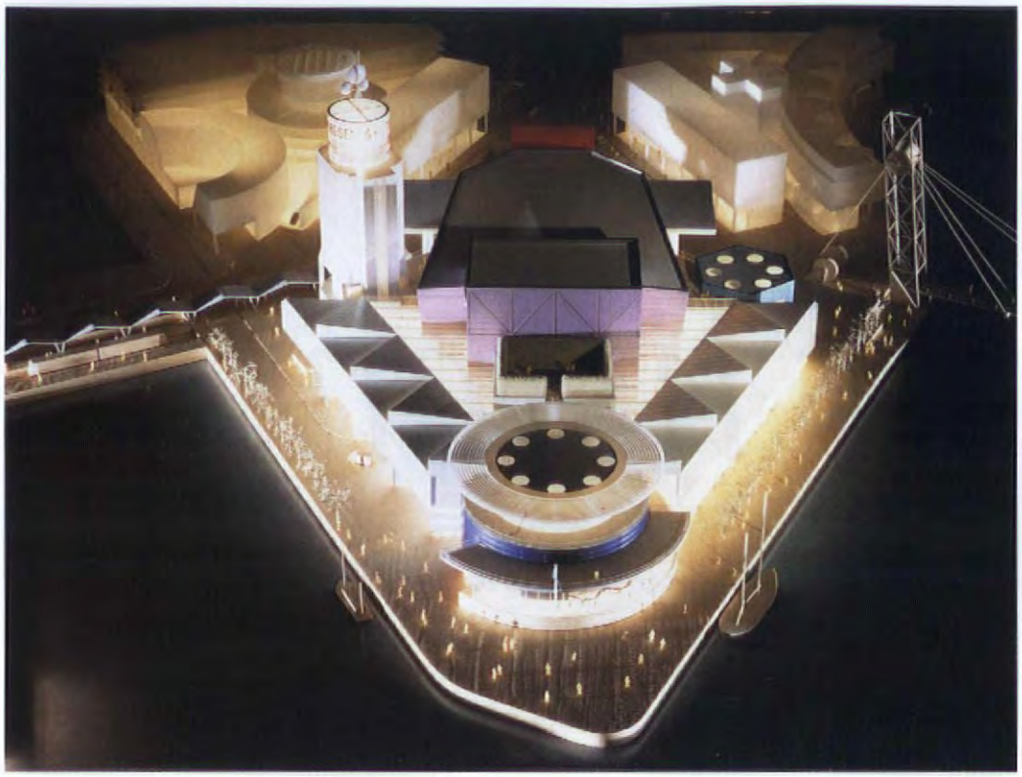


All images are taken from Arup Acoustics' computer models of the 2500-seat concert hall in the Istanbul Kültür ve Kongre Merkezi (Istanbul Culture and Congress Centre) project, Turkey. The project is currently at design detail stage

From top to bottom: Overhead plan; longditudinal section; axonometric; transverse section.
In the top three images the "source" (performer) is indicated on the right, and the listener, on the left







Belgium, Luxembourg and the Netherlands the foreigner is welcome although in the latter there are already many successful theatre architects such as Herman Herzberger, Rem Koolhass and Onno Greiner, all of whom are as anxious to work abroad as to retain their own home market. Scandinavia has always embraced competitions but the problem there is getting the winning entry built, perfectionism often leading to unacceptable cost estimates. Nevertheless earlier this decade Helsinki spent 12 times what Edinburgh did to fulfil its operatic needs.

Serena Vergano

1: Michael Wilford's Lowry Centre, Salford, Manchester, UK due for completion in 2000

2: Model of Behnisch, Behnisch + Partners' Bristol Centre for the Performing Arts, UK

3: Ricardo Bofill's National Theatre of Catalonia, Barcelona

Britain

Britain is one of the most active markets of all thanks to its National Lottery. While the popular press concentrates on the large sums being spent in London, whether the Royal Opera House for its much needed back stage support or the South Bank for its all weather sheath, a great deal is going on elsewhere. Many young architects have received the break they deserve when a new generation of arts administrators identifies itself with a new generation of architects. The sad story of Zaha Hadid's rejected designs for Cardiff Opera House has made unpopular open competitions for arts buildings which do not allow any dialogue between arts user and arts builder. In Cardiff the pendulum swung from the radical to the conservative when more discussion might have produced a building that would be both theatrically useable and architecturally innovative. Gateshead, part of the Newcastle-upon-Tyne conurbation, has just chosen a long list for the North of England Concert Hall which will be home to the distinguished Northern Philharmonia; a controlled ideas competition is to take place. Such was the process that resulted in Bristol in the much too rare event of a British limited competition being won by a non British architect, Behnisch of Stuttgart who won with a revolutionary idea for an asymmetric concert hall with the audience arranged on the vineyard steps pioneered by Scharoun and Cremer in Berlin in 1963.

The British have always distinguished between architect-led theatre buildings and theatre-led theatre buildings citing the National Theatre, unloved by actors, as one of the former and the Royal Exchange Manchester as the best of the latter. Both opened in 1976 and both are currently receiving extensive face lifts. But it is Manchester which is equally admired by architects and actors as well as audiences and is probably a better signpost to the future. WA

The art of listening

Richard Cowell is a man who has devoted his professional career to listening to buildings. His first question to any client is, "What would you like this building to sound like?" In conversation with Katherine MacInnes he explains that his ambition, as leader of Arup Acoustics, is to change the puzzled expression with which this question is typically greeted, by educating clients and architects in the art of listening. Portrait by Chris Floyd.

Richard Cowell maintains that much of the acoustic business has been built upon a negative premise of solving the "problems of noise". Most designers cannot imagine what they want their building to sound like: "The terminology can be so negative – we find we have to meet noise reduction criteria, not preferred sound criteria". So, if the architects are not aware of the design potential of acoustics, are Arup Acoustics no more than the aural equivalent of an insurance policy?

Although, as Cowell later describes, Arups are very effective at noise control, they encourage many varied shades of sound. Traditionally sound is nurtured in theatres and concert halls. At one stage they were designed by reinforcement of sound from the front, using a reflector over the platform. "It was only in the mid-60s that researchers pointed out that you wouldn't feel wrapped up in the performance unless you received reflections from the side."

Modern acoustics emerged with questions like: "How loud does it have to be?", and "Can we measure how clear the sound is?" Cowell explains: "We tested many different conditions and produced objective measures so that now we have a concept of 'clarity' which we can put numbers to and measure, and a concept of 'loudness' which we can put numbers to and measure. Similarly we can work with more complex concepts such as lateral energy fraction and inter-aural correlation. We are now in a position (there are a few of us, not many) to tell you with confidence that we will give you a good acoustic."

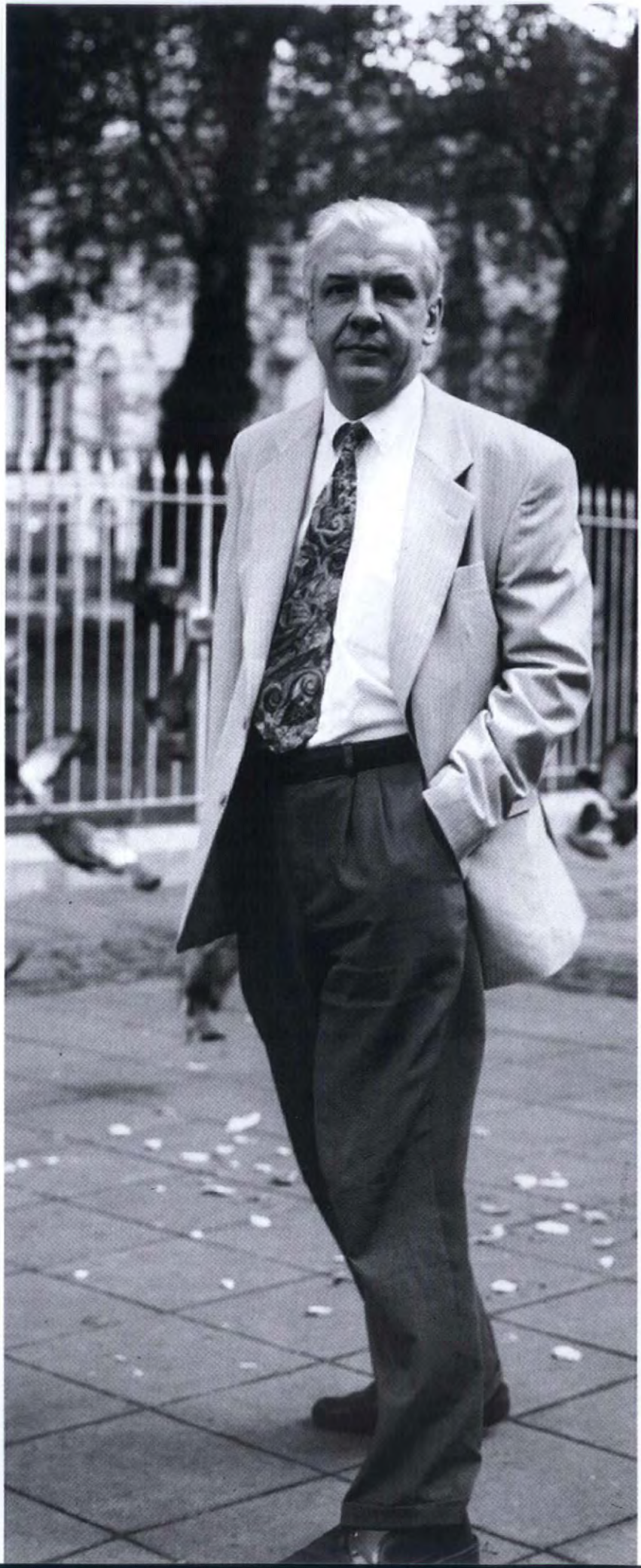
Although the acousticians are becoming educated in the science of sound, what stimulates the architects and clients to go to Arup Acoustics? "In the past we received many commissions because of the fear of the cost of noise and vibration control – the negative side again – but we have been turning this round." Cowell cited one example with RHWL's Bridgewater Hall in Manchester, UK (see building review), where the noise-excluding mechanism is so effective that the people inside the building were the only people in the city who didn't hear the recent IRA bomb. "It makes sense to have an auditorium in the middle and put your circulation and your support accommodation wrapped around it so that the traffic noise or trains etcetera are not directly exposed to the auditorium wall – so you cocoon the hall. Often, it seems, railways are very close to auditoriums, so the Birmingham Symphony Hall and Bridgewater Hall, Manchester, both have isolation systems in their foundations. The Birmingham one is built on rubber – the Manchester one on springs. All of this is to allow us to re-build the sound quality within the building."

"The terminology can be so negative – we find we have to meet noise reduction criteria, not preferred sound criteria"

Increasingly, Arup's acousticians are brought in at the beginning of a project. Cowell cites the concert hall in Fiat's Lingotto, Italy as an example of early involvement. "Renzo Piano invited Arup Acoustics into his early design stages through Peter Rice. We became involved in development of the design and model work, exploring ways of changing a concert hall into a conference centre by moving ceilings up and down and looking at the effect of that on the acoustics. The final acoustic, developed jointly with Fiat's acoustic advisers, is first rate. In the case of a concert hall, it is the building that actually generates the reverberation, the sense of space and the warmth in the music. It is the ultimate instrument if you like."

Multi-purpose halls remain as major challenges facing acousticians. "Administrators of most entertainment spaces these days are trying to make a living doing seven or eight other things" Cowell explains. "These bring conflict into the acoustic design. The lighting and technical equipment, which are inevitably left in position, absorb reverberant bass sound and we lose sound quality. So for example, with the Bridgewater Hall the lighting gantry actually disappears into the ceiling behind a substantial screen when they have a concert."

In Arup Acoustics' reception, there is a large acoustic model of the proposed Istanbul Concert Hall (see Theatres and concert halls introduction), developed as a fully integrated form. "If you look in there you can see the stair towers at the side" said Cowell pointing in through the removable roof. "They are not



"As we now go into the virtual environment, we will match the visual walk-through by listening as we go"

symmetrical, the angles on the side are positioned acoustically to give the right reflections. What is particularly interesting is that this is where East meets West. Turkey is absolutely where eastern music meets western music. We don't yet spend enough time in bringing together the different cultures into the criteria that we use for acoustic design. There have been a lot of western cultures taken over to the east and not enough bringing the eastern cultures back. In the case of speech, you will find that intelligibility is different in different languages. So if you are designing sound reinforcement systems you have to have different criteria for the intelligibility of Chinese of Japanese."

As well as national sound characteristics, do different cultures have different structural requirements: do the Japanese specify open air theatres more often than other cultures for example? "No, open air is not a specifically Asian phenomenon. The latest one we tackled was in Portugal. The trick there is the location. There are not many places which are both accessible to large audiences and free from noise. In the States we are looking at an outdoor theatre for the middle of a city. Unfortunately they are surrounded by urban noise which is likely to ruin the performance." He declines to name the city or project.

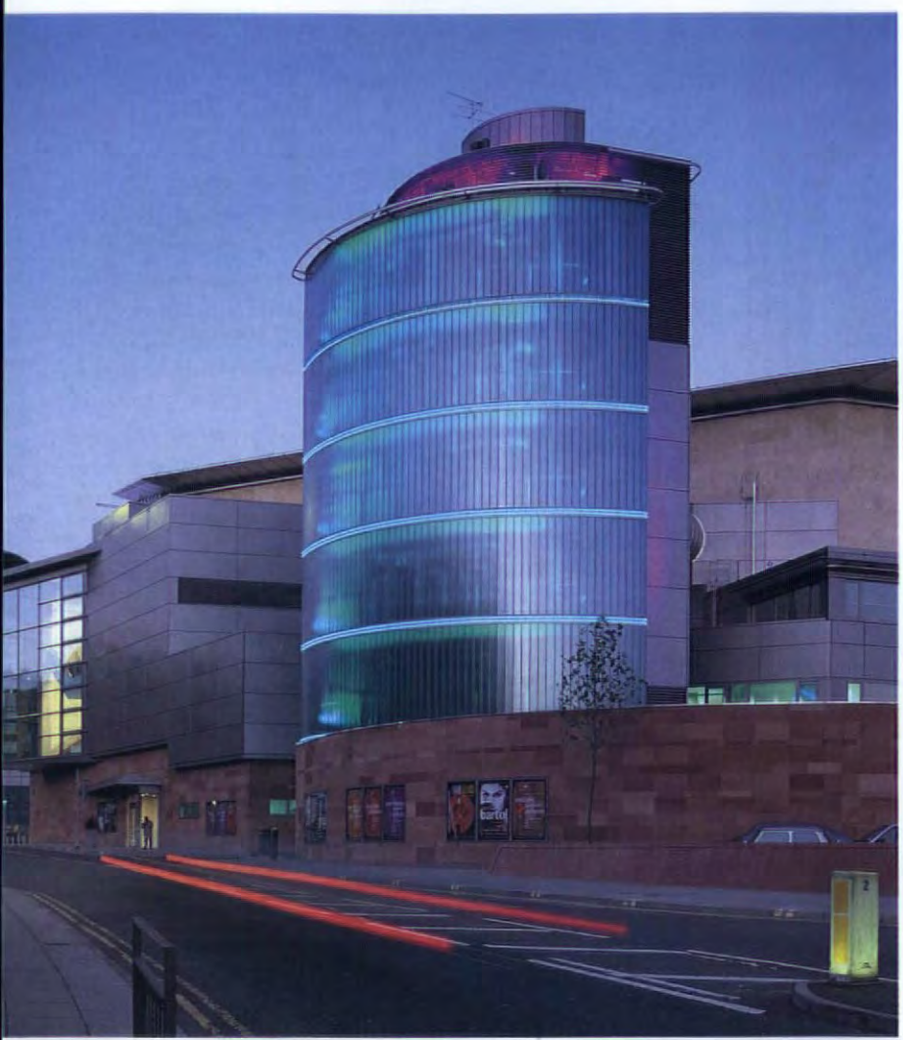
Looking to the future, Arup Acoustics is involved in, "listening to that building before it is built." Cowell explained: "Designers have been drawing fancy perspectives with vegetation growing all over their buildings for decades. They have not been selling the aural environment. We are beginning to do that now. We make acoustic scale models and we feed in sound at scale frequencies and we are listening to the response. We are getting closer to an accurate representation. This leads us to auralisation, the aural equivalent of visualisation. As we now go into the virtual environment, we will match the visual walk-through by listening as we go." WA

An extended interview with Richard Cowell is published in the profile on Ove Arup & Partners in the Top 125 Structural Engineers Survey in this issue.

Architects
Renton Howard Wood Levin (RHWL)
Photography
Dennis Gilbert

Music for the masses

Manchester Bridgewater Hall, Manchester, UK



1

1: The plant tower is housed in a separate and acoustically-isolated tower adjacent to the main building

2: A flight of steps takes concert goers down to the canal which runs alongside the building

2

The 2,400-seat Bridgewater Hall, designed by prolific theatre and concert hall-designers Renton Howard Wood Levin (RHWL), is named after the canal that runs alongside it. To the north of the hall is the historic, recently-bombed, city centre; to the south lies Castlefield, an industrial area of warehouses and transportation links currently being given new life by a surge in numbers of trendy bars and architects' offices. To the west of the site is the giant G-Mex exhibition hall. The task for the architects was to design a home for Manchester's Hallé orchestra that would attract national and international audiences, and fit within the urban context of the city.

The "Bridgewater Initiative" was launched in the late 1980s as a developer/architect competition. The idea was to design a space that made a clear statement about the relevance of music in the cultural life of Manchester, historically Britain's first industrial city. Due to the downturn in real estate during the 1990s Bridgewater Hall was ultimately constructed on a design and build contract with Laing North West. The office development north of the hall was under a separate contract. RHWL are justly proud of the end result, and describe Bridgewater Hall as "an outstanding exception" to the generally negative reputation of design and build.

The hall was built at a cost of US$67.2 million (£42 million) – partially supported by grants from Europe, as well as central and regional government – but with less than 13 percent of the adult population attending classical music events many have asked whether it is the best use of public funds. Although in itself, Bridgewater does not significantly increase jobs, its presence is expected to both stimulate employment and increase land values in central Manchester.

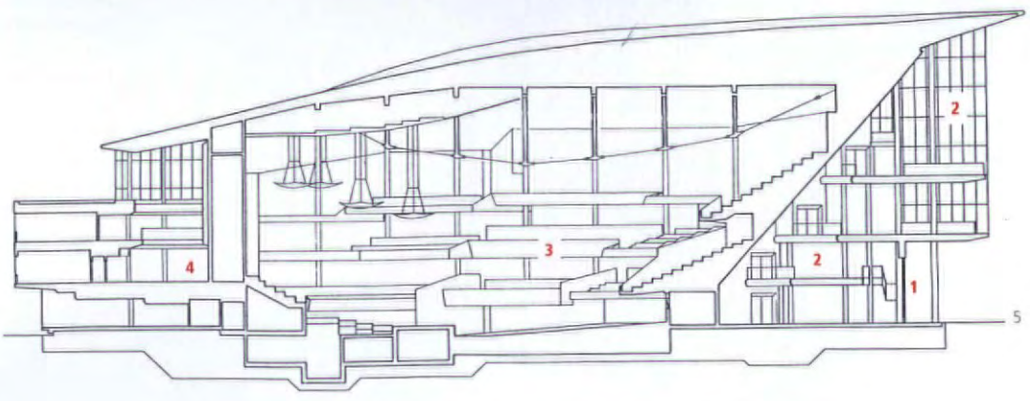
The building consists of a rich variety of materials and volume. The entire complex sits on a podium of red sandstone which contrasts with the glass prow rising five storeys above the main entrance culminating in a curved roof of stainless steel underlining the building's role as a civic landmark. The office walls are clad in silver metallic panels playing off the expanse of layered fenestration wrapped around the foyers ›

1&2: A dramatic glass prow denotes the main entrance and provides a glimpse of the interior

3: Section through the auditorium

3

4



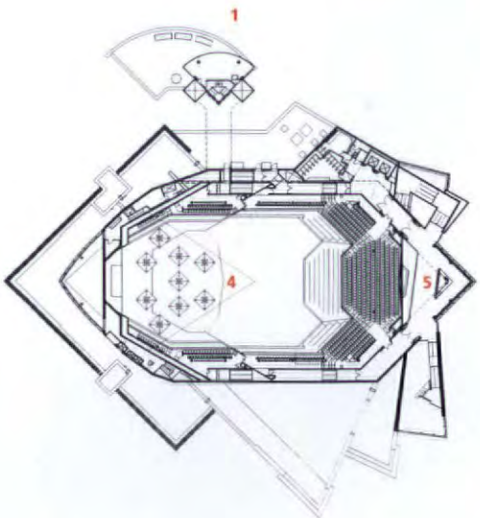
5

Key

1. Entrance
2. Foyer
3. Auditorium
4. Back stage facilities and administration

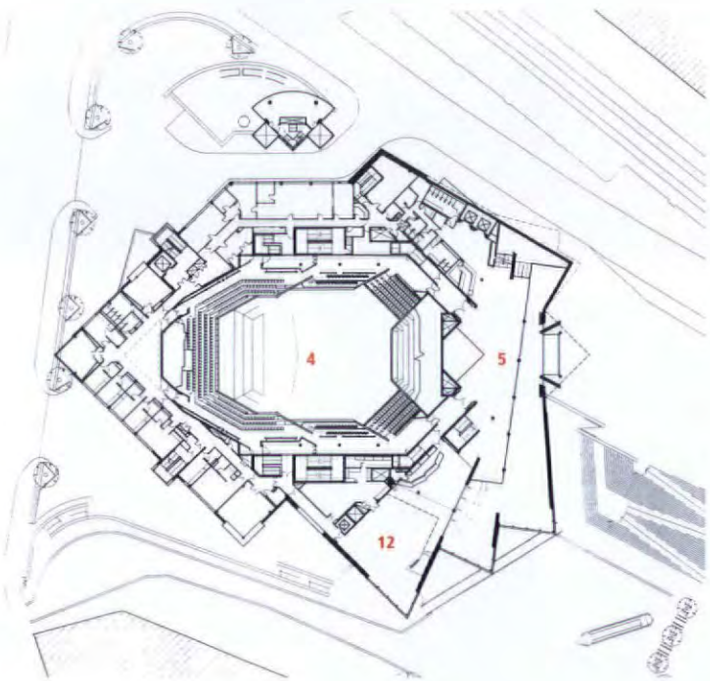
Key

1. Plant tower
2. Box office
3. Orchestra platform
4. Auditorium
5. Foyer
6. Entrance
7. Piazza
8. Canal basin
9. Lower Mosley Street
10. Great Bridgewater Street
11. Artists' entrance
12. Function room

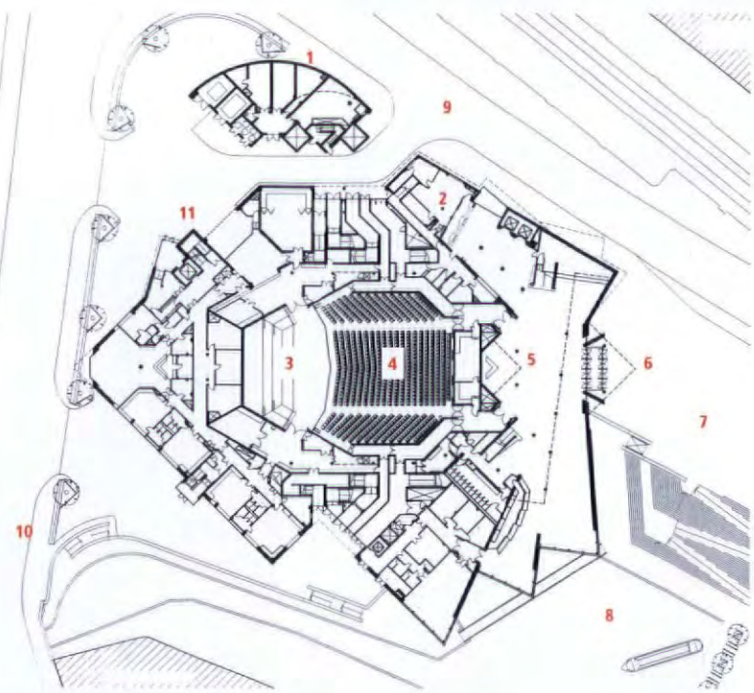


Level four

Level two



Level one



› and providing dramatic views of the city and canal basin.

The marine theme of the setting is continued in the minimally decorated interiors, with sea-blue carpeted foyers and elegantly designed staircases and bars which recall the furnishings of an ocean liner. The foyers are organised on two principal levels each with a mezzanine above and these are linked together by a grand staircase.

The performers' accommodation is planned around a lightwell with clerestory glazing beneath the roof which brings light down to the choir assembly area, providing clarity and a sense of community. The auditorium, at the heart of the building, is clad on the exterior, and partially on the interior, with Jura limestone, and is specifically designed for symphonic music. In contrast to the light, bright foyers and public areas, the colours and textures of the auditorium are muted and introverted, focusing attention on the performance area. The fair-faced concrete shell is exposed, and lined with painted plaster and cherry-veneered acoustic screens. The focal point of the concert chamber is the organ housed in a cherry wood case, also designed by RHWL.

The acoustic design synthesises the "shoe box" shape (used, for example, at the Amsterdam Concertegebouw) with the "vineyard" arrangement (Berlin Philarmonie). Relatively narrow stalls, parallel walls and the right angle corners of the "shoe box" design provide lateral sound reflections. The blocking of seats and additional wall surfaces of the "vineyard" design contribute to the impression of 360 degree "surround sound". The multi-faceted fair-faced ceiling provides sound diffusion. The building sits on vibration isolation springs to protect the auditorium from external noise. A double roof structure excludes noise from above. To optimise the sound between musicians, adjustable three-dimensional curved glass "ensemble" reflectors with integral platform lighting are suspended above the performers. VA

Client
Manchester City Council
Acoustician
Arup Acoustics
Engineer
Ove Arup & Partners
Technical installation
Technical Planning International
Lighting
Lighting Design Partnership
Quantity surveyor
Silk & Frazier
Main contractor
Laing North West

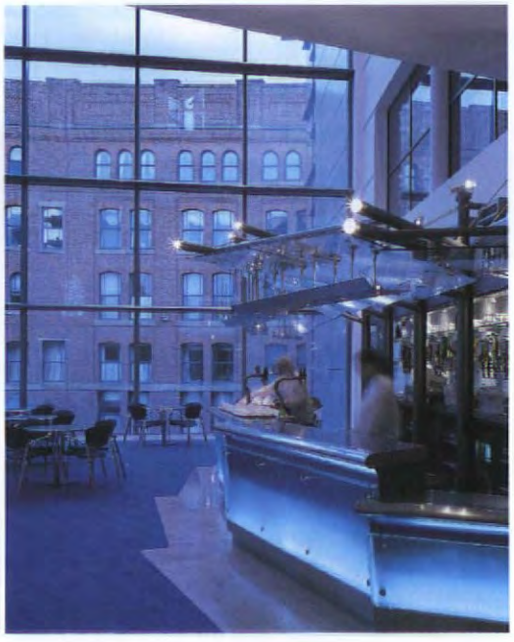
1: The auditorium is designed specifically for symphonic music, and is designed in a "vineyard" arrangement to create an intimate performance area

2: The foyers are organised on two principal levels each with a mezzanine above and linked together by a grand staircase

3: The bars are fitted with stainless steel and etched glass panels

1

2



3

Architects
William Rawn Associates
Photography
Steve Rosenthal

Just what the orchestra ordered

Seiji Ozawa Hall at Tanglewood, Lenox, Massachusetts, US

Any report on contemporary design of theatres and concert halls would be incomplete without a review of the US$9.7 million Seiji Ozawa Hall at Tanglewood, Massachusetts' highly acclaimed national centre of musical excellence. This first concert hall to have been designed by William Rawn Associates is the summer venue for the Boston Symphony Orchestra (BSO). That Rawn was able to design a hall with both world-class acoustics, and the stylistic sensitivity befitting a venue originally based on Quaker ideals, is testament to the levels of teamwork and communication between Rawn, acoustic consultants R Lawrence Kirkegaard & Associates and the BSO.

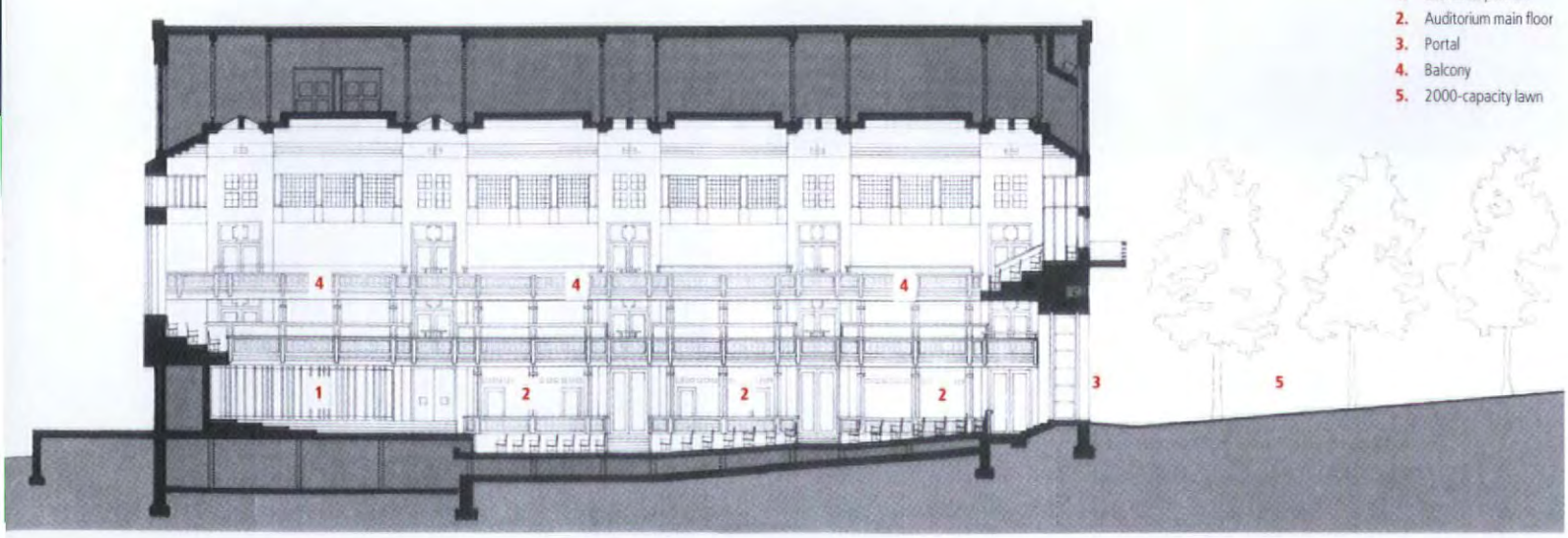
In the mid-1980s the BSO decided to replace Eero Saarinen's 1941 barn-like theatre with a "serious" concert hall, complete with suitably resonant acoustics. It was agreed that a "Room for Music" was required; a place that would capture the intimacy and immediacy of Saarinen's original, and re-create the "room-like" qualities of the great European concert halls such as Vienna's Musikvereinssal and the Schauspielhaus in Berlin, both visited by Rawn and Kirkegaard during the design process.

The orchestra and audience are not separated by a proscenium arch, as is still the case in the majority of American theatres and concert halls. The audience is seated around the orchestra, creating a sense of intimacy which is enhanced by the positioning of balconies overlooking the stage, where the audience can see "the whites of the orchestra's eyes". This democratic approach is visually extended by the use of basic, wooden, Quaker-style furnishings throughout the interior. The teak grilles and deck-type chairs suggest an air of wholesome, late-nineteenth-century leisure pursuits.

The local community are invited into the 1,200-seat "shoe-box"-shaped hall by means of a portal at its south-western extreme. Due to the high quality of the acoustics, which is enhanced by the 50-foot-high floor-to-ceiling space, the heavily articulated ceiling and thick side walls, the quality of sound is extended to the 2,000-capacity lawn. The side walls are comprised of brick and timber loggias to break down the mass of the building. The simple, curved roof, of lead-coated copper, softens the edge of the building and roots it in the landscape.

Named after the BSO's director of music since 1973, the Seiji Ozawa Hall is approaching the end of its first year in use. It has been well received from almost every quarter, although some critics complained about the apparent loss of distinction on the high notes – a problem Kirkegaard was able to solve by shaving an eighth of an inch off the cellulose fibre covering the ceiling. In a review of the opening night's performance *The New York Times* commended the Ozawa Hall as "precisely what a concert hall should be: a resonant, warm space that comes to life with music". WA

Longitudinal section
Key
1. Orchestra platform
2. Auditorium main floor
3. Portal
4. Balcony
5. 2000-capacity lawn



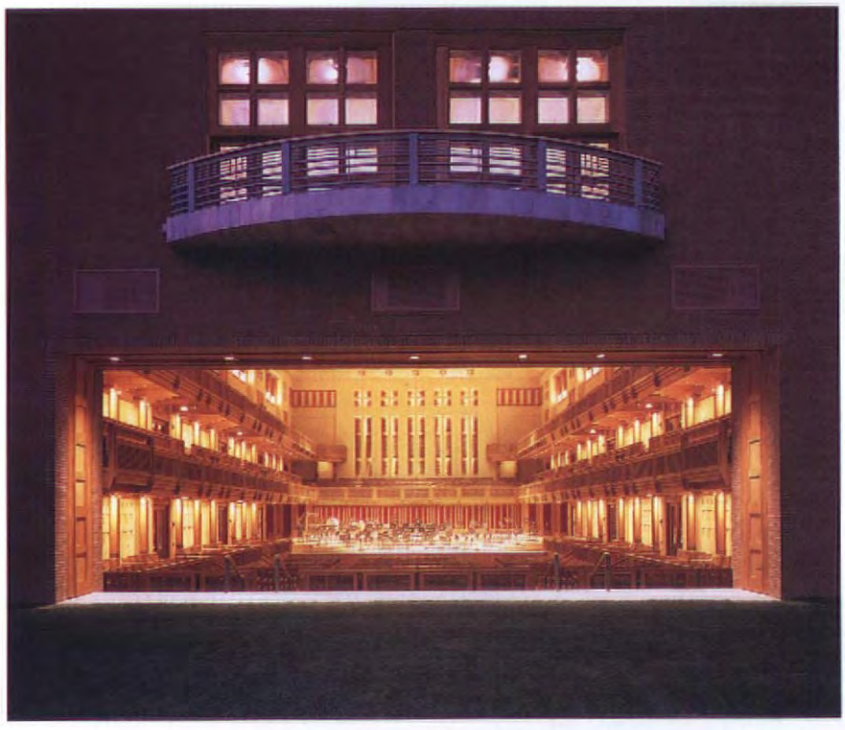
1: The Ozawa Hall's gently curving roof roots the building in the landscape

2: View through the portal, from the 2000-capacity lawn

3: Interior furnishings are strongly influenced by Quaker design principles

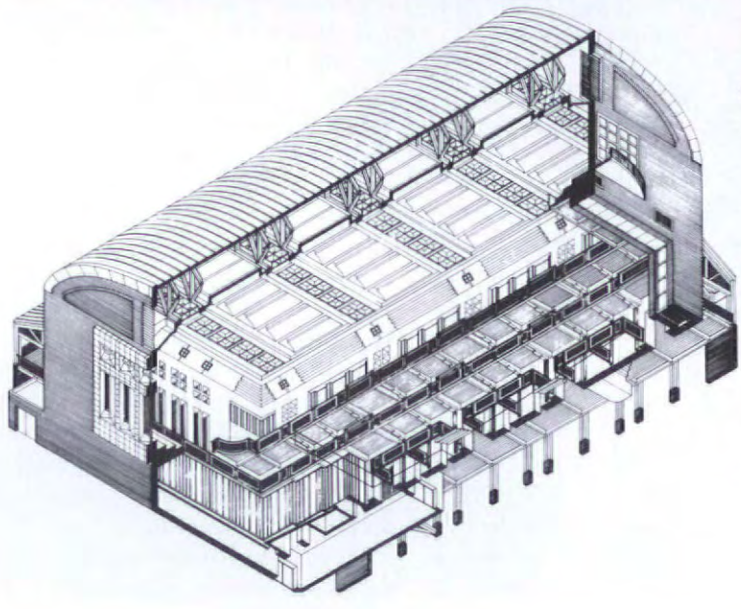
4: Dual axonometric of Ozawa Hall

1



2

3



4

Client
Boston Symphony Orchestra
Acoustic consultants
R Lawrence Kirkegaard & Associates
General contractor
Suffolk Construction Company
Landscape architect
Michael Van Valkenburgh Associates
Structural engineer
LeMessurier Consultants
Mechanical engineer
TMP Consulting Engineers
Electrical engineer
Lottero + Mason Associates

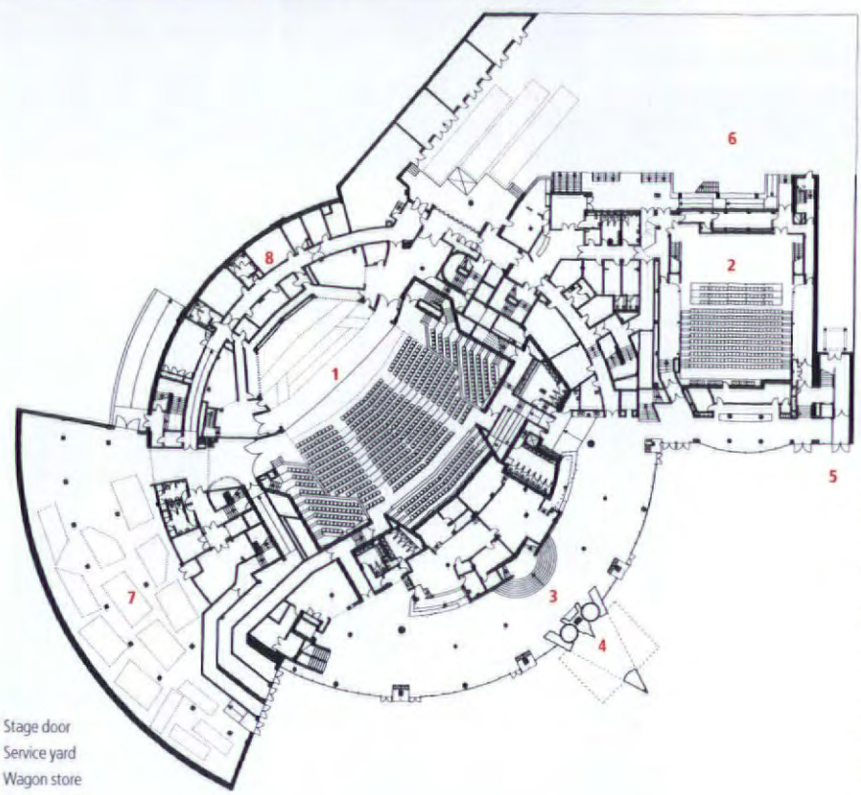
Architects
Robinson & McIlwaine
Photography
Christopher Hill Photographic

Belfast belle

Belfast Waterfront Hall, Northern Ireland, UK

1: A glazed curtain wall, which gives the hall an inviting exterior, floats at a six degree angle off the vertical

1



Concourse plan
Key

1. Auditorium
2. Studio
3. Foyer
4. Entrance porte cochère
5. Stage door
6. Service yard
7. Wagon store
8. Stage servicing

There is something uniquely serene about a concert hall on the water's edge. Just as Manchester's Bridgewater Hall is sited on the Bridgewater Canal, so Belfast's Waterfront Hall overlooks the River Lagan. Although the two share a similar approach to incorporating a transparent exterior to enable passers-by to see foyers, restaurants and bar areas from the exterior, enclosing the auditorium in the centre of the complexes, there are fundamental differences to the building forms. Whereas Bridgewater's angular geometry dominates the canal running alongside it, in Belfast Robinson & McIlwaine have designed what has variously been described by the Irish as a "crown" an "alien space craft" and a "pleasure dome". The Portland Stone drum seems to hover on the surface of the river; its copper dome, 27 metres above ground, appears suspended above a glazed curtain wall – which floats at a six degree angle off the vertical – and a semi-circular curved red brick wall regularly punched with square windows. The roof alone contains 500 tonnes of steel, and spans 56 metres.

The team, including international theatre consultants Carr & Angier, was appointed in 1978, but it was not until December 1991 that it was given the go ahead to proceed with the design. The brief was to design a civic building to incorporate both a concert hall and a conference centre facility for 2,250 capacity, as well as a smaller hall to seat 500.

Unlike Bridgewater, which was specifically designed as the home of a symphony orchestra, Belfast Waterfront Hall is possibly the most flexible performance space in Europe, able to adapt to different floor configurations including an orchestra pit and proscenium arch. The concert hall auditorium is a more flexible interpretation of the formula pioneered by Hans Sharoun at Berlin's Philharmonic Hall, with terraced "vineyard" seating, and includes capacity for a full size concert organ. The smaller hall, or studio, is rectangular with galleries on all sides and totally demountable seating. It is equipped with technical installations and has provision for varying the acoustic.

The circular shape of the building was determined by aesthetics, function and site,

2: The entrance is through a pair of copper-clad doors which are protected by a square glass canopy supported by a V-shaped granite-clad porte cochère

3: The "alien space craft" reflected in the water of the River Lagan

providing a distinct identity for the complex, and keeping the total floor area to a minimum by wrapping the foyers around the main auditorium. The circular form provides three dimensional volumes and shapes where the curved foyers are juxtaposed with the staircases. The curved plan also enables visitors to orientate themselves easily, and affords views across the water from all sides.

The entrance to the concert hall is through a huge pair of copper-clad doors, protected from harsh weather conditions by an eleven-square-metre glass canopy supported by a dramatic V-shaped granite-clad *porte cochère*. For reasons of economy of space there is only one open-air balcony, and this is situated above the entrance, and is accessed from the first floor foyer.

The transparency of this building describes its civic nature and is more inviting and less formal than Belfast's City Hall. The City Council have promoted the serenity of the concert hall to encourage a feeling of confidence within the city of Belfast in contrast to the destruction and fear wrought by ongoing terrorist activity. Tourism has suffered as a result of terrorism but Belfast should be helped by this much-needed new symbol for the outside world. WA

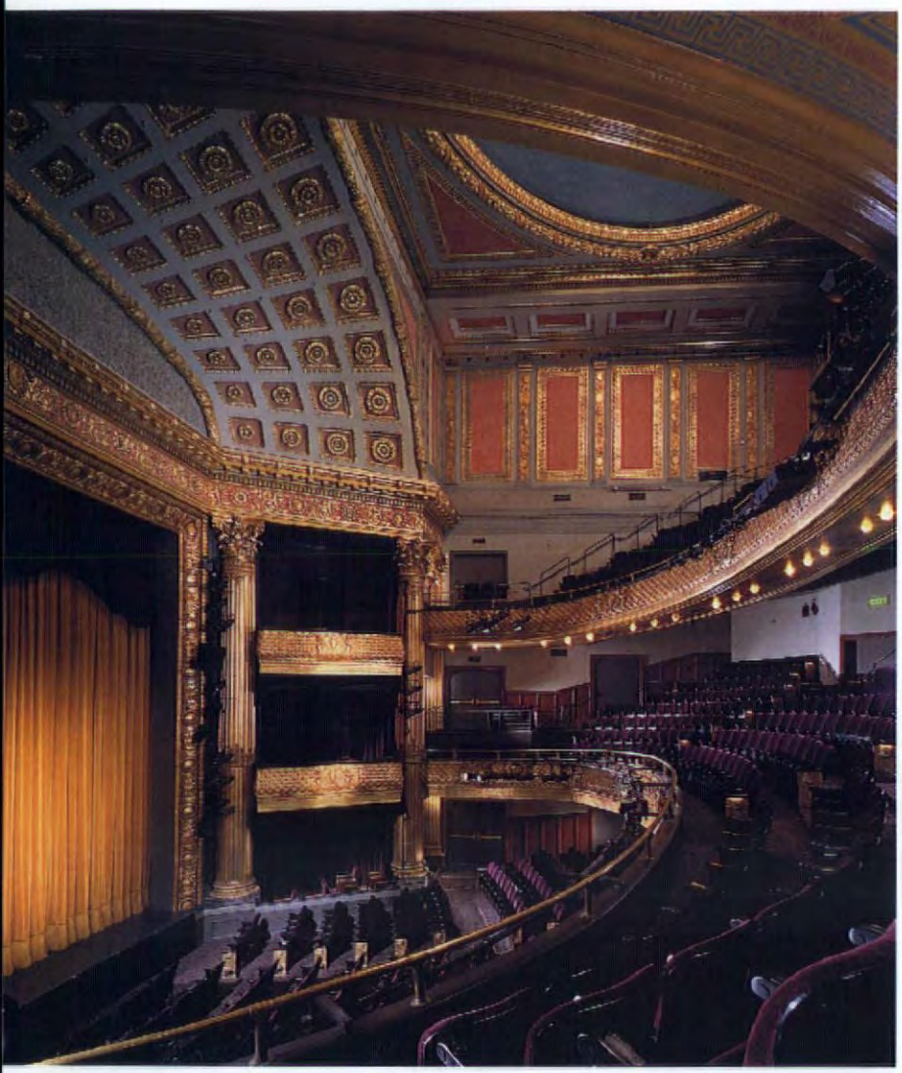
Client
Belfast City Council
Structural engineer
Kirk, McClure & Morton
M&E engineer
Mott MacDonald
Quantity surveyors
VB Evans
Acoustic consultants
Sandy Brown Associates
Theatre consultants
Carr & Angier

Architects
Gensler and Associates
Photography
M Lorenzetti

The calm after the earthquake

The American Conservatory Theater, San Francisco, US

1



2

The Geary Theater (1910), home to the American Conservatory Theater (ACT) in San Francisco, was badly damaged during the Loma Prieta earthquake of 1989. Two years later the ACT commissioned Gensler to develop a seismically-sound environment and overall design concept for the theatre, and to take the project through the process of reconstruction.

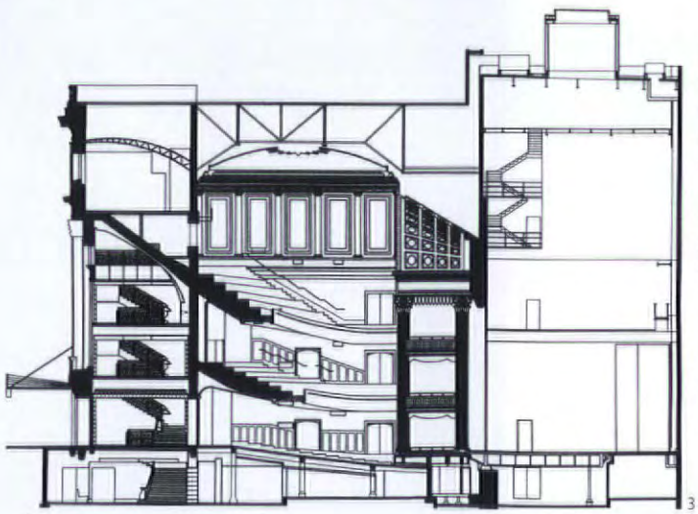
Both the ACT and Gensler saw the earthquake as an opportunity to restore the Geary to something resembling its original, luxurious glory, and to up-date the structure to meet contemporary public safety and seismic standards. A floor-to-ceiling wall was inserted at the rear of the auditorium to stabilise the building. Whilst this reduced the capacity of the auditorium, from 1,450 to 1,050, the sight lines for the remaining seats have been significantly improved, and the positioning of the wall has in turn provided space for several new lobbies and lounge areas at all levels. The internal reorganisation has also facilitated the use of the development of an upper lounge space for the first time, and accommodated elevators to serve all floors.

The elaborate, gilt baroque detailing in the public areas is not intended as a direct imitation of the original interior decorative scheme – rather Gensler, working in association with Debra Cibilich has sought to "enhance rather than compete with the historic" elements. Cibilich explains: "overscaling traditional details in a contemporary way kept it [the restoration] from being static". WA

1: View of the Geary Theater's elaborate baroque facade

2: Main auditorium. The addition of a stabilising wall has reduced capacity from 1,450 to 1,050, but sight lines have been improved

3: Section through the theatre



3

Client
American Conservatory Theater
Interior design
Gensler and Associates with Debra Cibilich Design
Construction manager
Cahill Contractors
Structural engineer
SOH & Associates
Electrical consultant
Cammisa & Wipf
Mechanical consultant
Guttman & MacRitchie
Design consultant
Theatre Projects Consultants

Architects
Hardy Holzmann Pfeiffer Associates
Photography
Whitney Cox

The show must go on

New Amsterdam Theater, New York, US

Located on Broadway in New York at 214 West 42nd Street, Henry Herts and Hugh Tallent's 1903 New Amsterdam Theater was renowned throughout New York for its dramatic Art Nouveau-based interior and Beaux Arts facade.

The structure, which is comprised of two main elements – the main theatre and rooftop theatre, and a ten-storey office tower which houses the main entrance to the theatre, vestibule and office space above – fell into disrepair after its ill-fated conversion into a cinema, in 1947. The 42nd Street Development Project (a joint partnership between the New York Empire State Development Corporation and the New York City Economic Development Corporation) purchased the site in 1984, and in July 1995 the Walt Disney Company signed a lease with the Development Project to restore and operate the theatre.

In approaching the New Amsterdam Theater restoration Hugh Hardy of HHP, "chose to honour its layers of history by undertaking an 'interpretative' restoration whereby this glorious old theatre [would become] a viable contemporary performance venue". Hardy sought to make optimal use of the New Amsterdam's existing strengths, principally its elaborate decoration and the interior flexibility offered by the skeleton steel construction.

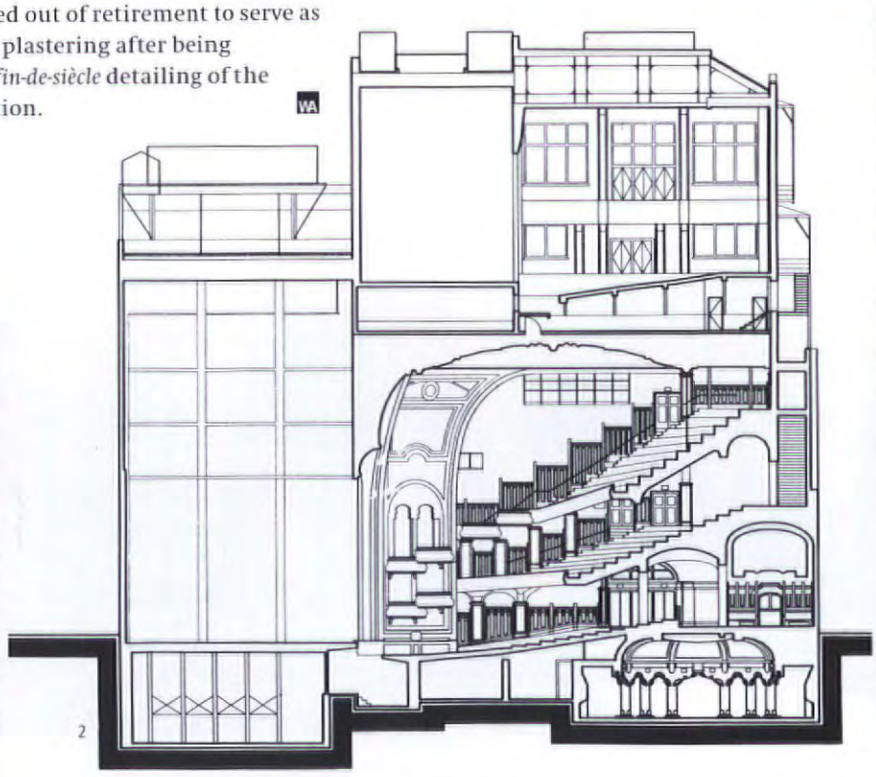
The stage has been designed to accommodate all manner of theatrical shows, from elaborate spectacles to intimate small-scale drama. It succeeds in combining the commercial potential of an 1,800-seat theatre with architectural integrity. The restoration of the interior was complicated by extensive water damage to the plaster and wood decoration as well as to the base structure. The first task of the restoration was to stabilise the building by repairing the roof and windows. A master plasterer was tempted out of retirement to serve as foreman for the plastering after being inspired by the *fin-de-siècle* detailing of the original decoration.

1: Detail of the boxes restored to their original splendour

2: Section through the theatre

3: The Art Nouveau interior of the auditorium

1



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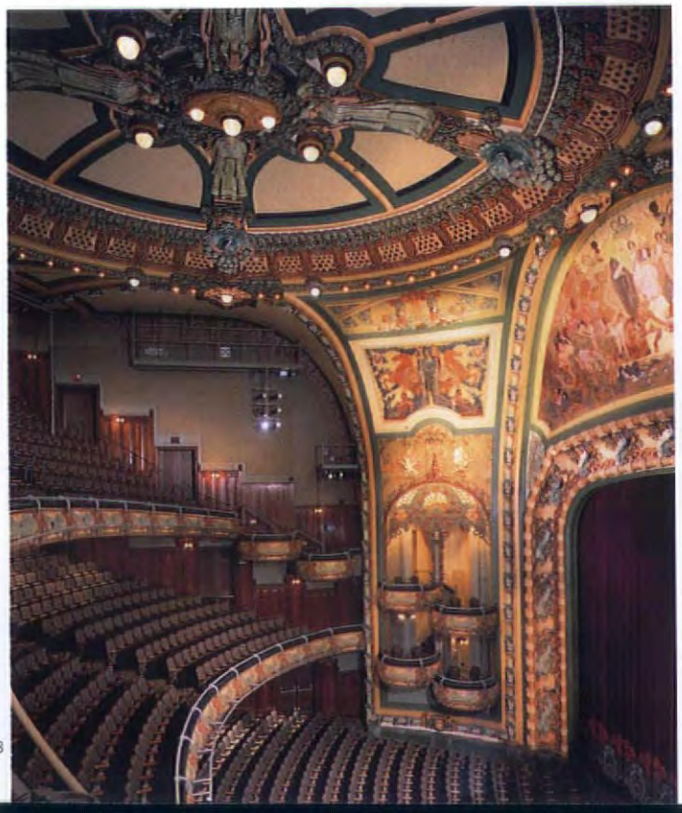


3

Client
Walt Disney Theatrical Productions
Developer
Walt Disney Imagineering
General contractor
Tishman Construction Corporation
Structural consultant
Desimone Chaplin & Dobryn PC
Restoration consultant
Building Conservation Associates Inc

Making a stand for the big bands

International sports stadiums are the domain of some of the world's most impressive spectacles – from Superbowl and FA Cup Finals to dramatic Rock'n'roll extravaganzas. Rock'n'roll briefly transforms the buildings into dramatic theatres for up to 70,000 people. Then it moves on, leaving the stadiums unchanged. Audiences do not attend stadium rock concerts just for the music; attendance is best understood as a tribal ritual similar to attending a sports event. The stage provides a focus for the energy of the crowd, becoming the altar on which the high priests perform. Mark Fisher, one of the leading architects in this arena, describes the concept and creation of three recent stage set designs for the Rolling Stones, *Voodoo Lounge*; Pink Floyd *Division Bell*, and most recently U2's *Popmart*.

1

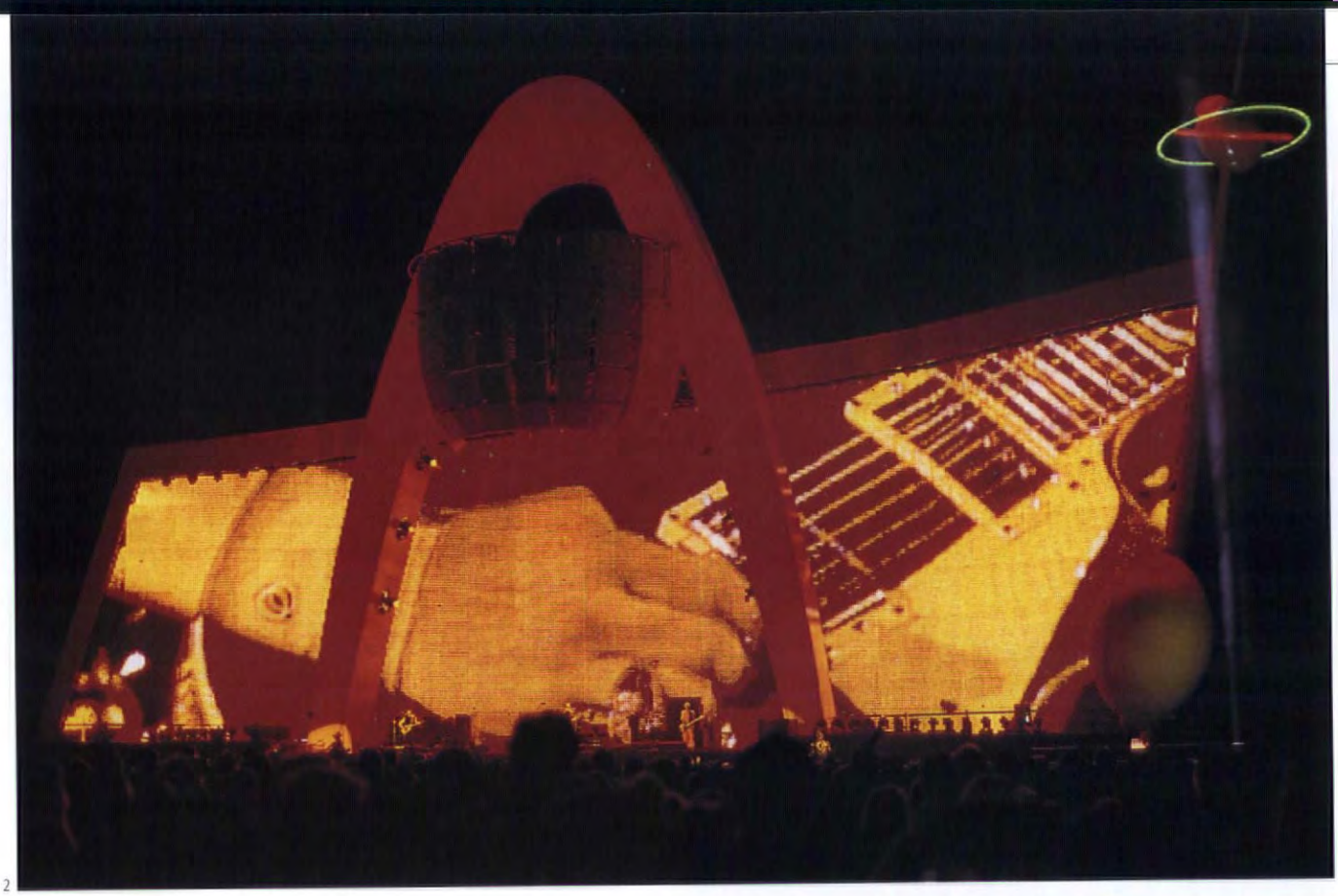
1: The U2 Popmart set designed as a touring supermarket; a satire on consumer decadence

Faced with the contradictory task of creating intimate performances in massive stadiums, most artists when instructing their stage-set designers, seek to increase the communion between themselves and their audience by using the technology of presentation to reduce the barriers of scale and distance. The architecture of the stage is part of the presentation. As well as providing technical support, the form and style of the stage can have a narrative relationship with the performance. The audience usually arrive in daylight, so the stage can be used in the afternoon to set the style and build a sense of anticipation before the show. Almost any design will work as long as it is consistent with the self-image of the performer. And anything is possible as long as the functional aspects of the design programme are met.

U2 *Popmart* (1997-8)

Three bands show different approaches to engaging the tribal emotions of their audiences. U2's *Popmart* is a touring supermarket, a satire on *fin-de-siècle* consumer decadence. The show appropriates many of the symbols of consumer culture, making the vulgar face of brand management the product rather than the process. But the show is a double blind, because the media management that supports a globally successful rock band employs all the strategies of a multinational corporation.

The public facade of the *Popmart* stage is very



2

2: The world's largest full-colour video screen is assembled from clusters of LED pixels mounted in lightweight aluminium frames

3: Late in the show the fluorescent yellow cover of the 12-metre-high lemon is stripped off to reveal the revolving mirror-ball lemon beneath

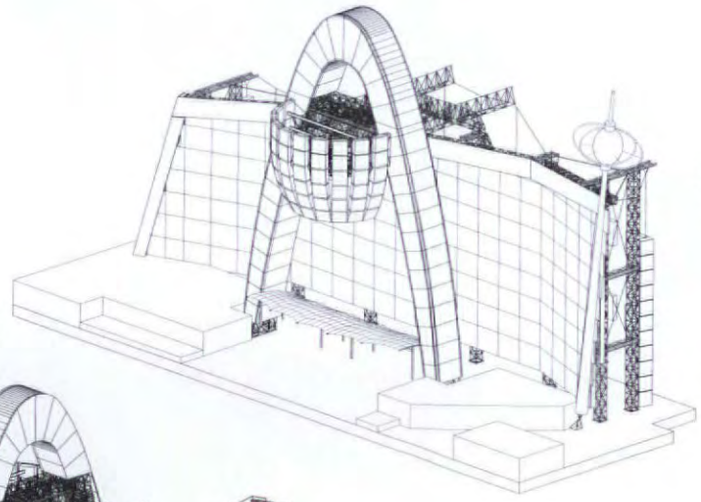
Photography Mark Fisher

3

slick. Appropriately for a project dedicated to consumption, it borrows motifs from the futurist moderne period of Miami Beach and the LA Basin, the architecture of Googie and Morris Lapidus. The strip mall styling completely conceals the practical structure. The base of the structure is 60 metres wide, the width of most football stadiums. At the back, separating the stage from the clutter of the stadium, is the largest full colour video screen in the world.

The 700-square-metre screen was specially built for the tour. Forming a strong, streamlined shape, it is 50 metres wide and averages 16 metres high, painted with the *Popmart* logo in metallic gold and red. The screen is assembled from clusters of LED pixels mounted in lightweight aluminium frames. The frames are only 50 percent solid, so that in certain lighting conditions it is possible to see right through the screen. Images running on the screen appear to hang in space, with the dark parts of the picture showing through to the real world behind.

The streamlined outline of the screen is trimmed with a glossy magenta fascia concealing an array of lighting equipment. At the high end, the screen is finished with a 30-metre-tall orange cocktail stick complete with pimento stuffed olive and planetary orbits. At the foot of the cocktail stick is a 12-metre-high florescent yellow lemon mounted on a self-propelled truck. Late in the show, the florescent cover is stripped off to reveal the revolving ›



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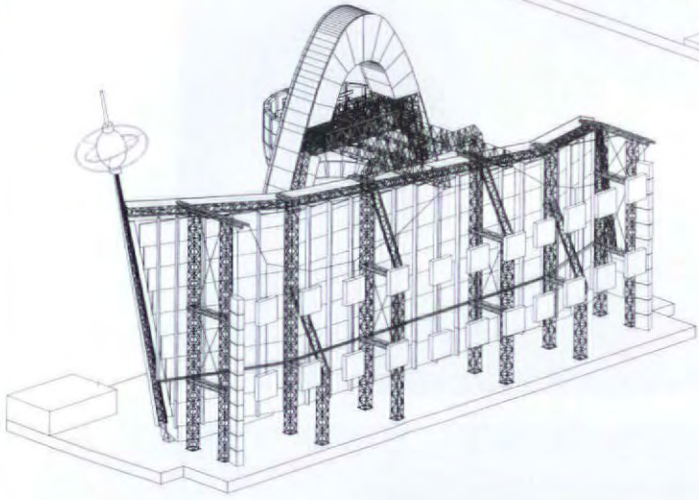

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› mirror-ball lemon beneath, which transports the band to a smaller stage 50 metres out into the audience. The main performance area for the band is in the centre of the stage in front of the screen beneath a 30-metre-high yellow plastic-clad parabolic arch which supports a cluster of 60 bright orange PA cabinets.

The *Popmart* video screen is the centrepiece of the production and a wide range of video material is run on it. Reversing the original crossover between popular culture and high art, paintings by Roy Lichtenstein, Keith Haring and Andy Warhol have been specially animated to punctuate the show with stadium-scale pop art. Along with slowly changing patterns by Brian Eno and provocative animation by a number of contemporary video artists, the images create a dynamic billboard. The band parade in front of it, and are featured on it at a scale so large that their likeness, from the rear of a stadium, appears larger than their likeness on most living room televisions. But they rarely engage with the stage on which

1: Front isometric view of U2's Popmart stage set

2: Rear isometric view

3: The Rolling Stones' Voodoo Lounge was a futuristic composition of stainless steel and aluminium

4: In the middle of the show the stage was transformed into a shrine by a collection of banal inflatable icons

3

4

U2 POPMART
Show director
Willie Williams
Architect
Mark Fisher

PINK FLOYD DIVISION BELL
Show director
Marc Brickman
Architect
Mark Fisher

ROLLING STONES VOODOO LOUNGE
Show director
Patrick Woodroffe
Stage design
Mark Fisher and Jonathan Park

5: For Pink Floyd's Division Bell the stadium was transformed into a mystical gateway to other worlds

6: Lasers, lights and pyrotechnics carried the show beyond the confines of the arch

they perform and their presence in the stadium is almost completely mediated by the video screen.

Pink Floyd *Division Bell* (1994)

The Pink Floyd *Division Bell* stage was intended to transform the end of the stadium into a mystical gateway to other worlds. By day the arch was wilfully grey and enigmatic; while the tunnel was open the worlds within remained invisible until the band came on stage to unlock them. During the show the arch and the apse behind became a huge cyclorama surrounding the band. Computer controlled lights within the arch and projectors outside it were used to create a series of graphic and abstract moving backgrounds. A 15-metre-diameter rear projection screen rose up inside the arch, back-projected with pin-sharp vibrant technicolour films created to enhance the dream-like ideas embodied in the music. Lasers, lights, pyrotechnics and inflatables carried the show beyond the confines of the arch even though the band themselves were never enlarged. From the back of the stadium, the musicians were almost invisible gatekeepers patrolling the threshold of a surreal, parallel universe.

The Rolling Stones *Voodoo Lounge* (1994-5)

In contrast to the bland daylight quality of the Pink Floyd stage, the Rolling Stones *Voodoo Lounge* (1994-5) stage design was an expressionist monument; a futuristic composition of stainless steel and aluminium. At the centre of the composition was a 70-square-metre video screen, used both for graphics and live images of the band. When the show began the lighting transformed the stage into a "city of the future'" bound by gravity but otherwise unlimited by function. The band are astonishing showmen, and they colonised the stage, racing across the runways and ramparts, their presence amplified by the video screen. Overlaid on this *Buck Rogers* futurism were darker images which reflected the contradiction between the supernatural world of the human spirit and the rational world of cyberspace. In the middle of the concert the stage was transformed into a suburban shrine by a collection of banal inflatable icons. WA

1

Handle with care

Architects have always been passionate about detail, and given the pivotal role of the notion of "total design" in the emergence of modernism, this may be more relevant to twentieth century architects than their predecessors. Nicola Kearton takes hold of the door handle as a case study to explore recent developments in the architect's on-going struggle to assert his/her "vision" of the built environment.

2

1: Eero Aarnio-designed door handle produced in collaboration with Fusital

2: Detail of d line door handle for use in the Hong Kong Convention and Exhibition Centre

Obsession has often led architects to design their own hardware, or to choose hardware designed by a firm which will respond sympathetically to their needs. FSB, a case in point and one of the best-known of architectural hardware firms, chose for their trademark the door handle designed by Ludwig Wittgenstein, who perhaps best epitomised this manic search for pared-down perfection and complete design control. Door handles in particular have become design icons. Perhaps this is because handles are generally the only part of an architectural scheme which provide not just a visual but a directly tangible and sensual experience.

Second-rate fittings, applied later by developers or contractors, have ruined many a scheme. It is not surprising therefore that many architects design fittings themselves, a strong reason often being that their needs are not readily met by the market place. For instance, the unavailability of aesthetically acceptable architectural hardware for the disabled encouraged German-born Gabrielle Bramante to set about designing her own. Her clear acrylic grab rails for disabled toilets at the Citizen's Advice Bureau, Chessington, UK were an elegant solution to this problem. Specially fabricated with secret back-to-back fixings she fitted floor pivots instead of hinges and flush fitted rubber implants which act as kick plates for wheel chairs.

However for those who do not want to design their own, some of the most exciting firms providing architectural hardware have specialised in collaborating with architects and internationally acclaimed designers and one of the best places to see their latest offerings was the Cologne International Hardware Fair (4-8 March 1997).

Fusital, established in 1976 has always promoted collaboration with renowned names in architecture and design in order to lift the handle out of design anonymity (see WA46 for feature on Foster and Partners' range for Fusital). Fusital's most recent collaboration, promoted at Cologne, is with Catalan architect Ricardo Bofill's Taller de Arquitectura which has developed a new handle series called RB Novanacinque. This includes a door handle and window pull with co-ordinated door key, key escutcheon and privacy set. It comes in two finishes: polished brass and satin chrome. Fusital has recently launched a series of stylish stainless steel handles using chrome nickel molybdenum stainless steel, which is

maintenance free and highly resistant to corrosion, rust and fire. This includes a stunning example by Finnish interior and architectural designer Eero Aarnio.

FSB, based in Brakel, Germany and founded in 1881, have also collaborated with a host of figures over the years including Johannes Potente, Philippe Starck, Hans Hollein, Alessandro Mendini and Jasper Morrison. Through their commissions for architectural hardware they have been attempting to explore regional design sensibility, the most recent of which has been with the Danish designer Erik Magnussen, one of the figures who, along with Arne Jacobsen, did so much to put Scandinavian design on the map.

The collection of handles Magnussen has produced with FSB are typical of the pure, functional, minimalist forms with which he made his name. The inspiration behind this collection of folded flat strips of stainless steel is said to come from the wing-beat of a seagull. Characteristic of his functionalist leanings, the designer insisted that the pieces were to be produced simply by being folded, not bent, welded or widened. The collection, or "product family", includes several lever handles, a back plate, a doorknob, a smattering of cabinet and window handles, a pull for wood or glass doors, a wall hook and a door stop.

d line international the Danish company, founded in 1970 by Carl F Petersen and another Scandinavian design guru, architect Knud Holscher, is one of the forerunners in this field. Their guiding principles are that objects should be cleanly designed and rigorously functional and they have made it a policy to use AISI 316 stainless steel which guarantees minimum maintenance and maximum durability. It also withstands high humidity climates which has been especially important in their recent commission to produce fittings for the Hong Kong Convention and Exhibition Centre. Designed by Skidmore Owings and Merrill, the building is to host the official transfer of sovereignty to China in June 1997. d line's collection includes door stops, lever handles and pull handles.

3

Tim Soar

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3: Gabrielle Bramante's acrylic grab rail for the disabled toilets in situ, St George's Hospital, Tooting, UK

4: The "Egg" door handle by Colombo Design, a combination of matt chrome and blue glass

5: Interior of Bramante's CAB, Chessington featuring full-length door pull

1

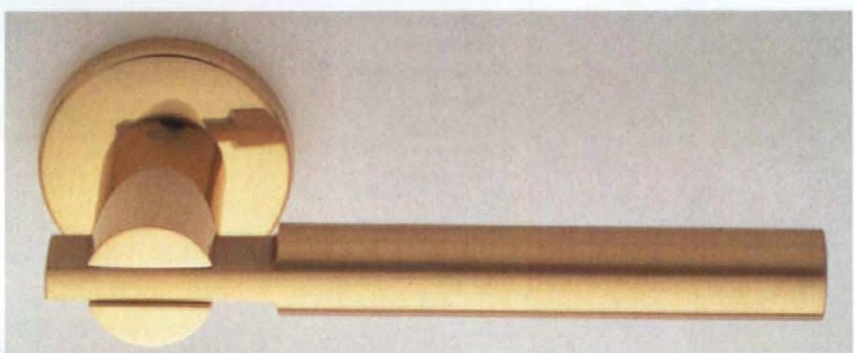
2

1: Eric Magnussen-designed stainless steel door fittings, produced by FSB

2: Colombo Design's "Ludus" range, designed by Bonini Spicciolato

3: The polished brass version of the RB Novantacinque door handle series by Ricardo Bofill's Taller de Arquitectura

4: As above, in satin chrome. The series was premiered at the 1997 Cologne International Hardware Fair



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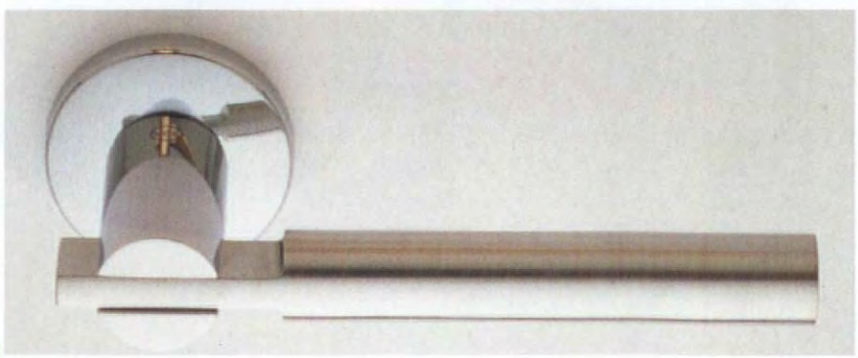

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Colombo Design, created in 1990, have also entrusted the design of their handles programme and bathroom accessories to a group of eminent designers including Carlo Bartoli, Castiglia Associati, Alberto Meda and Makio Hasulke with consistently pleasing results. In keeping with their forward-thinking approach, they have recently made a break with their most commonly used brass and chrome alloys introducing new materials with their recent designs "Egg" and "Ludus". "Egg", a series of door and window handles by the father and daughter team of Anna and Carlo Bartoli, features finishes of polished brass with pink glass or white porcelain; chrome with either frosted blue, clear green glass or white porcelain; or mat chrome with frosted or shiny blue glass. "Ludus", by the design group Bonini Spicciolato features brass with chromat finish together with funky cast polyester resin in blue, apple green, orange, anthracite and smoke grey. These extremely tactile handles seem reminiscent of Alessi's recent fun-oriented ranges of household implements, an attempt to introduce some humour as well as an alternative to the functionalism of the northern European stainless steel designs. VA

Franchi International

Worldwide distributors of door and window fittings of classic and contemporary designs. The Fusital lever (right) designed by Foster & Partners complements the Olivari, Arius, Kleiss and Mandelli ranges. These collections are on show at Franchi International's showroom at the Chelsea Harbour Design Centre.

Franchi International Ltd
Unit 2/11
Chelsea Harbour Design Centre
Lots Road
London
SW10 0XE
UK
Contact: Marco Franchi
Tel: +44 171 351 4554
Fax: +44 171 351 2803

HEWI Heinrich Wilke GmbH

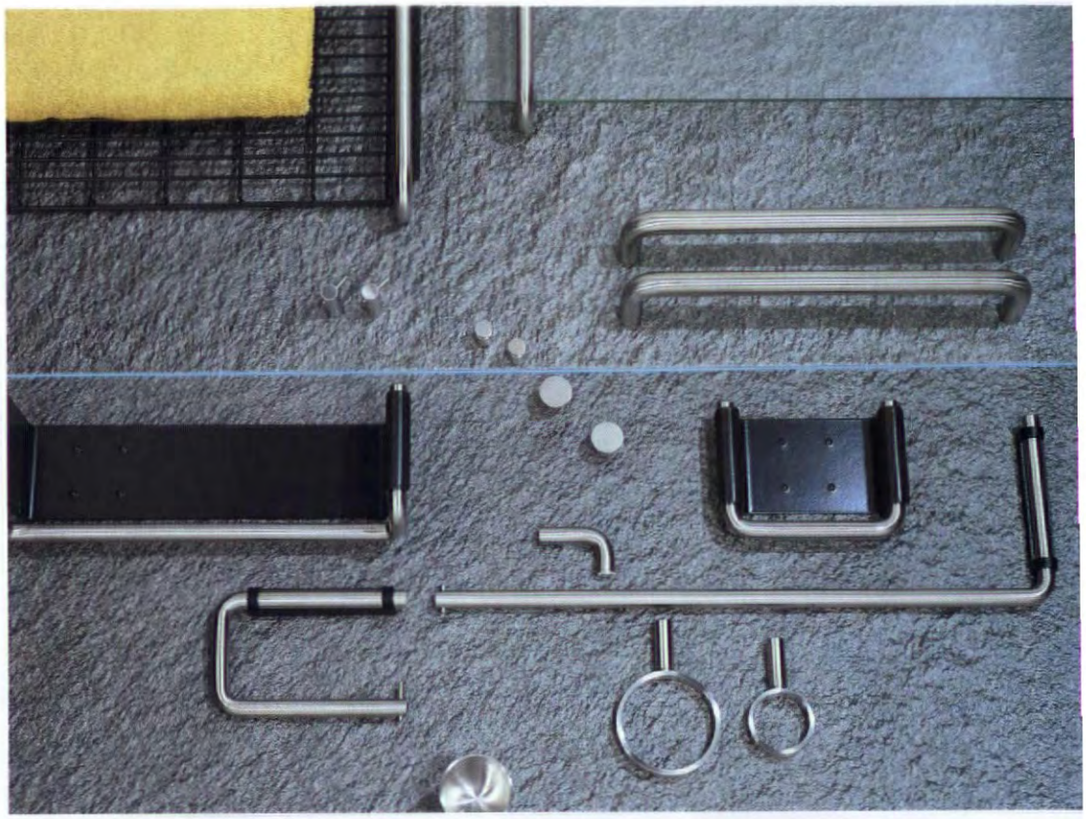
Elegance and a sweeping form distinguish the new handle 131 from HEWI

HEWI Heinrich Wilke GmbH
Techno Press
Postfach 10 04 49
42004 Wuppertal
Germany
Tel: +49 202 970 1031

Handles and Fittings Ltd

Exciting new additions to their SteelTech ranges of stainless steel architectural hardware are announced by Handles and Fittings Ltd. Designed by Parisian designers J L Mellerio in collaboration with Stephen George of Handles and Fittings this new range symbolises the increasing unity within the European Community. Items available include pull handles, knobs and robe hooks as well as the lever handle illustrated. Finishes are satin and polished stainless steel, polished and satin brass.

Handles and Fittings Ltd
HAF House
Mead Lane
Hertford
Herts SG13 7AP
UK
Contact: Nicole Gay
Tel: +44 1992 505655
Fax: +44 1992 505705



d line™

Emphasising the Bathroom

"A hardware programme offering solutions from a building's entrance to bathroom".

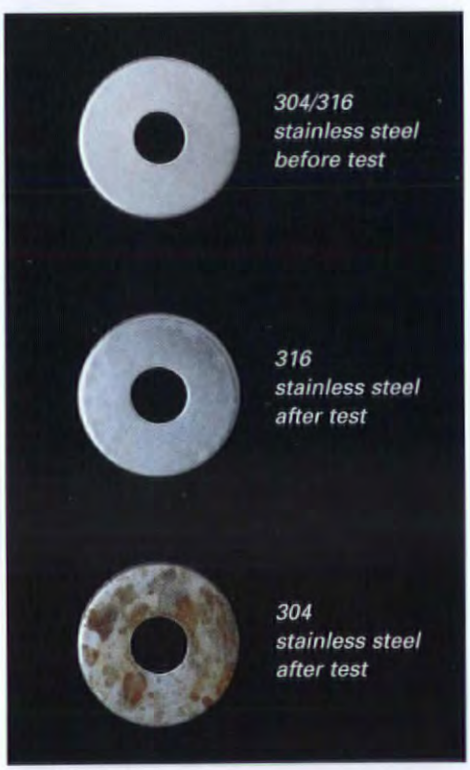
The **d line** range of products is renowned for it's comprehensive selection of more than 2000 components encompassing pull handles, door and window lever handles, door accessories and bathroom fittings. In the past, emphasis has been placed on the architectural ironmongery sector, however, **d line**™ *international as* has been rapidly developing the bathroom fittings range and in 1997 the primary strategy is to expand this particular market niche.

Toilets and bathrooms are often a neglected area where fittings are concerned, not because of lack of interest but rather due to the lack of choice. How often are fittings of widely differing design and material found in the same room? The **d line** concept unifies all product functions in the same design, thereby offering a harmonic hardware solution throughout a building. This is achieved through co-ordinating the design of both door hardware with bathroom fittings; waste paper bin, a variety of dispensers, soap dish (magnetic and dispenser), toilet roll holder, coat hooks, pictograms etc.. In fact all the items that are required to complete a commercial or residential bathroom area.

As a high degree of humidity is often found in toilets and bathroom environments **d line** bathroom fittings are produced in polished and satin stainless steel grade AISI 316 (WST 1.4435), due to the benefits of this material.

Stainless steel is renowned for the following two properties; resistance to corrosion and low maintenance requirements. Aggressive environmental conditions, such as bathroom areas, can cause the following effects on stainless steel; rusting, pitting, unsightly staining and, in some cases, permanent damage. However, the degree of damage has been proven to be reduced by using higher grade stainless steel.

An independent test initiated by **d line**™ *international as* via the Force Institute, Copenhagen, an independent research company, investigated the effects on stainless steel under an accelerated corrosion test. Involving both AISI 304 and AISI 316 grade ground stainless steel products the aim of this severe laboratory test is to show the differing corrosion and rust formation levels occurring on the two stainless steel grades.



The result of the investigation clearly showed that AISI 316 offers better resistance against rust formation than AISI 304. This result complies with previous

Opposite page:
Below right: **d line** *Bathroom Fittings Programme*
Below left: **d line** *Magnetic Soap Holder and Coat Hook*

Below left: **d line** *Cup Dispenser*
Below right: **d line** *Numerals and letters*
Bottom: **d line** *Literature*

tests carried out at the Force Institute using these stainless steel grades involving rust formation levels.

As a result of the independent tests **d line**™ *international as* has made it policy to use AISI 316 stainless steel, or the corresponding stainless steel grade, in the manufacture of all **d line** products, allowing for stock rotation. Naturally, this policy has entailed considerable cost within the manufacturing phase, however, the company has absorbed this through rationalisation.

Design Zentrum
Nordrhein Westfalen
Design Innovations
Award for High Design Quality

The use of AISI 316 stainless steel in the manufacture of **d line** products ensures that the quality finish of products is maintained, despite only a minimum of maintenance, in aggressive environments, such as heavy industrial, large city, coastal and offshore situations. Additionally, certain aggressive internal environments may demand AISI 316 properties; such as swimming pool areas, buildings where high levels of hygiene are required, for example, bathrooms, hospitals, laboratories and kitchens.

Furthermore, the design and manufacture of **d line** has taken into account the problems of theft and vandalism; the **d line** fixing technique reduces the possibility of theft to a minimum.

Over the years **d line** products have been awarded a variety of design prizes; the bathroom fittings themselves winning Die Gute Industrieform in 1982 and most recently the **d line** cup dispenser being awarded the German **iF Product Design Award 1997**. Additionally, the **d line** cup dispenser and **d line** numerals and letters have been awarded the German **Red Dot for High Design Quality 1997**.

d line™ *international as* has been involved in a vast number of international commercial projects where bathroom fittings have been specified and installed. In addition to standard products, **d line**™ *international as* is renowned for expertise in the field of special products in accordance to the architects' and projects' requirements.

Continuous development through a co-operation between **d line**™ *international as* and Professor, Architect Knud Holscher ensures that the design and manufacture of

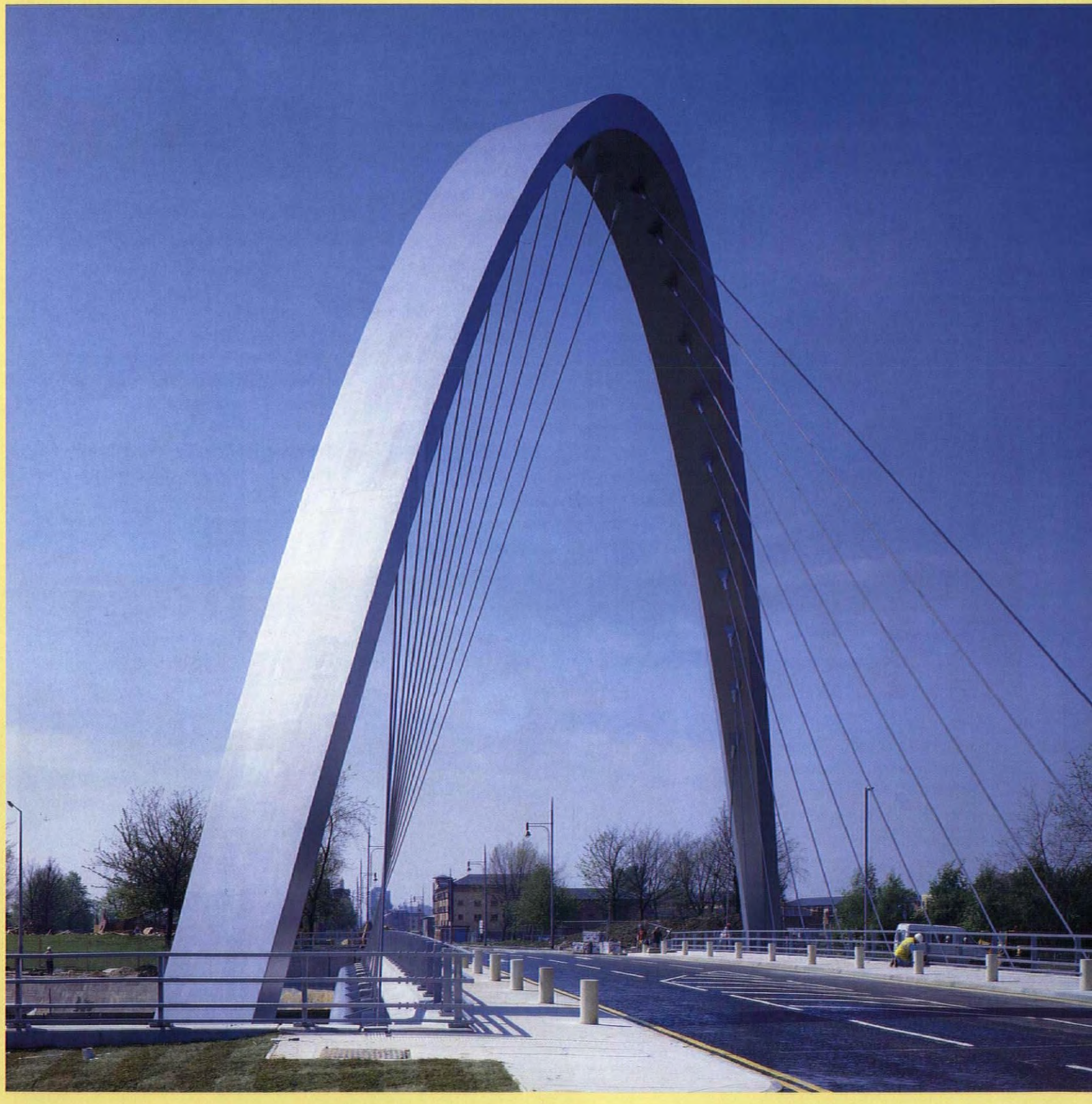
Design Zentrum
Nordrhein Westfalen
Design Innovations
Award for High Design Quality

the **d line** range benefits from interaction between an experienced manufacturer and an internationally-renowned designer.

A new **d line** Bathroom Fittings catalogue has been developed from the **d line** main catalogue and includes all the appropriate **d line** products available for use within a bathroom environment.

d line is manufactured in Denmark by **d line**™ *international as*, which is a DS/EN 9001 : 1994, certified company.

1997 Survey of the World's Largest 125 Structural Engineers



Competition-winning design of a single-span 50-metre road and foot bridge with a 25-metre high diagonal steel arch to carry the deck. Structural engineers: Ove Arup & Partners ; Architect: Chris Wilkinson; Client: City of Manchester

World Architecture's first global survey of structural engineers provides a vital insight into construction trends not only in the structural engineering profession but in the international building industry as a whole. World Architecture reveals the fee contribution of structural engineers within giant multi-disciplinary firms; the income of the specialist structural engineering firms; the hottest market sectors attracting their talents, and an exclusive league table of the largest 125 structural engineering firms in the world. Plus a 24-page profile of the chart-topping UK firm Ove Arup & Partners – the architects' favourite engineers.

Europe closes the gap on US

Leaders of the pack

In this, our first survey of the world's leading structural engineers, Western Europe comes out on top in the league table based on the number of structural engineers, although North America still dominates in the breakdown of top firms by fee income. Western Europe accounts for the largest slice of the global market. At the other end of the league table it is particularly interesting to see India beginning to establish a presence, notably with Mumbai-based STUP Consultants achieving equal 18th ranking, ahead of some more familiar western names.

However, the single most dominant presence is that of UK firm Ove Arup & Partners. Arup's number one position in the top 125 worldwide and its strong presence in so many sectors is a remarkable testimony to the firm's continuing success. Another UK firm, WS Atkins Architects Limited are also well represented, as are Dutch giant DHV Beheer BV.

Booming sectors

Industrial and manufacturing buildings and business parks prove to be the sectors that are witnessing the greatest activity, with the majority of firms anticipating a broad increase of work in these areas.

Western Europe leads the field in the provision of structural engineering work, with the Pacific Rim and China also making an impressive showing. Specialist structural engineering firms proved relatively rare – four out of five of respondents to *World Architecture* were multi-disciplinary practices.

Structural engineers in context

The survey results are presented in a number of ways that give a variety of perspectives on a vital profession. Around 80 percent of the firms assessed are multi-disciplinary. Structural engineering activity is therefore susceptible to being absorbed into the operations of much larger firms, so complicating the separation of specific information. It is for this reason that any building professional seeking a clear overview of structural engineering trends has in the past frequently been frustrated. Now for the first time we can offer clear and authoritative tables and charts which not only train the spotlight onto the profession but also attempt to examine its relationship with associated disciplines.

Reading the ranking tables

The rankings in the *World Architecture* league table of top 125 structural engineering firms

Mir Katsuhisa Kida

Bordeaux Law Courts, France, currently under construction. Structural engineers: OTH Sud-Ouest and Ove Arup & Partners. Architects: Richard Rogers Partnership

Top global 25 by fee income

	Country	band
Black & Veatch	US	12
Cowi Consulting Engineers and Planners AS	Denmark	12
Daniel Mann Johnson & Mendenhall	US	12
DHV Beheer BV	The Netherlands	12
Earth Tech. Inc.	US	12
Fugro N.V.	The Netherlands	12
Holmes & Narver Inc.	US	12
Law Engineering & Environmental Services, Inc.	US	12
Lockwood Greene Engineers Inc.	US	12
Louis Berger International, Inc.	US	12
Mott MacDonald	UK	12
Nikken Sekkei Limited	Japan	12
Ove Arup & Partners	UK	12
Parsons Brinckerhoff	US	12
Sverdrup Corporation	US	12
Hyder Consulting Limited	UK	11
Nihon Sekkei, Inc	Japan	11
AB Jacobson & Widmark	Sweden	10
Kume Sekkei Co. Limited	Japan	10
Oranjewoud	The Netherlands	10
Scott Wilson Kirkpatrick	UK	10
Scandiaconsult A.B.	Sweden	9
Gannett Fleming, Inc.	US	8
Gibb Ltd	UK	8
Babtie Group Limited	UK	7
Carter & Burgess, Inc.	US	7
Connell Wagner	New Zealand	7
Consoer Townsend Envirodyne Engineers, Inc.	US	7
Rust Kennedy & Donkin	UK	7
Sir William Halcrow & Partners Limited	UK	7
Tractebel Development	Belgium	7

The top 25 firms assessed by fee income showing the US featuring most dominantly. For the purposes of our survey the top fee band has no ceiling, here resulting in several tied places

Key to Fee band:

1 = under $5m US	7 = $ 80m - $100m US
2 = $5m - $10m US	8 = $100m - $120m US
3 = $10m - $20m US	9 = $120m - $140m US
4 = $20m - $40m US	10 = $140m - $160m US
5 = $40m - $60m US	11 = $160m - $180m US
6 = $60m - $80m US	12 = over $180m US

are based upon the number of structural engineers employed worldwide. In this regard a few words of explanation may prove helpful. The assumption here and elsewhere in this survey is that the number of dedicated employees is likely to be a fair representation of workload. In many cases the structural engineering element forms part of a multi-disciplinary firm, and in such circumstances – not to mention in such a highly competitive marketplace – there is no reason to suppose that any firm will maintain unrealistic numbers of professionals, in whatever discipline. That said, one might argue that structural engineering fee income is an equally significant indicator of pre-eminence; for this reason you will find on this page a list of top performers ranked by fee income.

We have also analysed activity by sector and region. The internationalism that lies at the heart of a survey like this raises questions about "nationality". Take-overs and amalgamations are only part of the difficulty involved in accurately assessing the real identities of those companies that maintain a multinational presence within the profession. Here we have applied the strict rule that the head office location defines the nationality of a firm, even if its overseas activities are conducted from foreign locations.

We look forward to bringing you a comparative survey of international structural engineers in 1998. We welcome your comments.

Quality of service

Participants in the survey were invited to nominate "quality of service" partners in the fields of civil engineering, contracting, cost consulting and architecture. Unsurprisingly, many structural engineers who operate as part of a multi-disciplinary firm tended to nominate their stable mates. Where greater levels of impartiality could be reasonably assumed we used recommendations to compile a list of most-cited popular partners.

Top 3 Civil engineers
1 Ove Arup
2 Hyder Consulting
3 Atkins

Top 3 Cost consultants
1 Hanscomb
2 Davis Langdon & Everest (ACE)
3 Gleeds

Top 3 Contractors
1 Turner Construction
2 Bovis
3 Laing Construction

Top 4 Architects
1 HOK (Hellmuth Obata Kassabaum)
1 Foster
2 KPF (Kohn Pedersen Fox)
2 SOM (Skidmore Owings & Merrill)

The top 125 league table

1997 Rank	Firm's name	Total structural engineers worldwide	Total staff worldwide	Total national offices	Total international offices	Country	Fee band (US$m) – see key	Sectors – see key
1	Ove Arup & Partners	1520	4838	17	45	UK	12	a,b,c,d,e,f,g,h,j,k,l,m,n,o,p,q,r,s,t,u,w
2	WS Atkins Architects Limited	1058	7500	49	28	UK	4	a,d,e,f,g,h,j,n,q,t,x
3	DHV Beheer BV	1000	2500	15	30	The Netherlands	12	u, v, x
4	Mouchel	771	942	7	14	UK	6	b,m,v,x
5	Carl Bro Group A/S	390	1969			Denmark		a,b,c,h,k,l,m,n,p,q,s
6	Norconsult International A/S	374	2600			Norway		a,b,c,m,p,q,s
7	Hyder Consulting Limited	359	3206	25	51	UK	11	a,b,c,d,e,f,g,h,j,k,l,m,n,o,p,q,r,s,t,u
8=	Scandiaconsult A.B.	350	1867	30	20	Sweden	9	a,b,c,d,e,f,h,m,n,o,p,s,v
8=	Royal Haskoning Group	350	1150	4	18	The Netherlands	4	b,c,m,r,s,v
8=	AB Jacobson & Widmark	350	1500	100	4	Sweden	10	a,b,c,e,f,g,m,n,x
11	Cowi Consulting Engineers and Planners AS	340	2240	20	23	Denmark	12	a,b,c,e,f,h,j,l,m,n,p,q,r,s,u,v,w
12	Parsons Brinckerhoff	339	5320	55	26	US	12	a,b,c,e,f,g,m,n,s,u,v,w
13=	Meinhardt International Pty Limited	300	1000	7		Australia	5	a,b,c,e,f,g,h,j,n,p,q
13=	Lockwood Greene Engineers Inc.	300	2600	24	6	US	12	d,e,f,h,m,o
13=	Mott MacDonald	300	4200	20	50	UK	12	a,b,c,e,h,j,m,n,q,s,t,v,w,x
13=	Waterman Partnership Limited	300	500	9	2	UK	4	a,b,c,d,e,f,g,h,j,k,l,m,n,o,p,q,r,s,t,x
17	Louis Berger International, Inc.	276	2800	19	235	US	12	a,b,c,d,e,f,g,h,j,k,m,n,p,q,r,s,t,u,x
18=	Scott Wilson Kirkpatrick	200	2650	20	40	UK	10	a,b,e,h,m,n,q,r,s,t,u,v
18=	Black & Veatch	200	6600	46	44	US	12	a,b,c,d,e,f,g,h,j,k,l,m,n,q,r,s,w,x
18=	Babtie Group Limited	200	1425	20	6	UK	7	a,b,c,d,e,f,g,h,j,l,m,n,p,q,r,s,u
18=	Nellemann, Nielsen & Rauschenberger A/S	200	480	4		Denmark	5	a,c,f,h,j,n,p,q,t,v,x
18=	STUP Consultants	200	500	10	4	India	2	a,b,c,e,f,g,h,j,m,n,o,p,q,r,s,t,w,x
23	Weidlinger Associates, Inc.	170	220	5		US	3	a,b,c,d,e,f,g,j,o,p,t
24	Reudel Palmer & Tritton Limited	166	403	8	31	UK	4	a,b,h,m,n,r,s,
25=	Beca Carter Hollings & Ferner Limited	160	1183	5	6	New Zealand	5	a,b,c,e,g,h,j,m,p,q,s,t,x
25=	Gibb Ltd	160	1600	6	37	UK	8	a,c,d,f,h,j,m,n,p,q,s,x
25=	Finnmap Consulting OY	160	165	5	2	Finland	2	b,c,d,e,f,g,h,j,m,n,p,t
28	Sverdrup Corporation	159	5000	35	6	US	12	a,b,c,d,e,f,g,h,j,m,n,o,p,q,rs,t,x
29	China Engineering Consultants Inc	156	1584		0	Taiwan		a,b,f,h,m,n
30	Grebner Ingenieure Beteiligungsgesellschaft mbH	154	450	22	3	Germany	4	a,b,c,e,f,g,h,n,o,p,q,s,v
31	Harris & Sutherland	153	246	1	3	UK	3	a,b,c,e,f,g,j,k,m,n,p,r
32=	Berdal Strømme Q.S.	150	450	12		Norway	5	a,b,d,h,m,n,q,s,w,x,
32=	TT-CBM Engineers	150	230	3		US	3	a,c,e,f,g,h,k,p,q
32=	A/S Sanfundsteknik	150	220	16	2	Denmark	1	a,b,d,e,f,h,k,l,o,p,q,s,t,v
32=	Coppee-Courtoy (SNC Lavalin)	150	6000	3		Belgium	4	c,d,f,g,h,n,q,x
36	Greiner Engineering Inc.	140	1561			US		a,b,c,e,f,g,h,j,q
37	John A. Martin & Associates, Inc.	139	384	19	1	US	5	a,b,c,d,e,f,g,h,j,k,l,o,p,q,s,t,x
38	Connell Wagner	130	1250	16	12	New Zealand	7	a,b,c,d,e,f,h,j,k,l,m,n,o,p,q,r,s,t,x
39	The Maunsell Group	124	1007			Hong Kong		a,b,e,f,h,j,m,n,p,s,t
40	Pacific Consultants International	123	1555			Japan		a,b,c,e,j,n,s,t
41	KPFF Consulting Engineers	121	353	6		US	4	a,b,c,d,e,f,g,h,m,q,t,
42	Chung Suk Engineering Co. Limited	120	250	250		South Korea	4	a,b,j,m,n,r,s,x
43	SECO (Technical Control Bureau for Construction)	115	150	1	1	Belgium	3	x

Key to fee band:

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4 = $20m - $40m US
5 = $40m - $60m US
6 = $60m - $80m US
7 = $ 80m - $100m US
8 = $100m - $120m US
9 = $120m - $140m US
10 = $140m - $160m US
11 = $160m - $180m US
12 = over $180m US

Key to sector:

a = Airports
b = Bridges & tunnels
c = Business parks & offices
d = Defence
e = Educational buildings
f = Healthcare
g = Hotel/restaurants
h = Industrial/manufacturing
j = Leisure/hospitality
k = Libraries
l = Museums/art galleries
m = Ports & harbours
n = Railways
o = Research facilities
p = Residential
q = Retail/shopping centres
r = Rivers/coastal
s = Roads
t = Sports stadiums
u = Waste water/sewage
v = Environment
w = Power/gas/oil
x = Unspecified or other

1997 Rank	Firm's name	Total structural engineers worldwide	Total staff worldwide	Total national offices	Total international offices	Country	Fee band (US$m) – see key	Sectors – see key
44=	Law Engineering & Environmental Services, Inc.	110	4500	60	37	US	12	a,b,c,d,e,f,g,hj,k,l,m,n,o,p,q,r,s,t
44=	Taywood Engineering Limited	110	327	2	7	UK	4	a,b,c,d,f,g,h,jm,n,o,p,q,r,t,w,x
46	SNC-Lavalin International Inc.	105	4158			Canada		a,b,c,e,f,h,j,m
47	Nikken Sekkei Limited	104	1788	21	3	Japan	12	a,c,e,f,g,h,j,k,l,o,pq,r,t,x
48	Parkman Limited	103	816	13	9	UK	5	a,b,c,e,h,m,n,p,q,s,t,u,v,x
49=	Oranjewoud	100	1600	5		The Netherlands	10	b,c,e,f,g,h,j,m,n,q,s,t
49=	Consoer Townsend Envirodyne Engineers, Inc.	100	750	24		US	7	a,b,e,h,n,s
49=	Aaro Kohonen Oy	100	100	4	1	Finland	2	a,c,g,h,k,t
49=	IFB Dr. Braschel GmbH	100	300	5		Germany	4	a,c,d,e,f,g,h,j,k,l,o,p,q,t,x
49=	Mitchell McFarlane Brentnall & Partners International Ltd.	100	200	1	7	Hong Kong	2	a,c,e,g,h,p,q,t
49=	Sener Ingeniera y Sistemas, S.A.	100	842	3	2	Spain	2	a,b,c,h,m,n,r,s,x
55=	Henningson, Durham & Richardson, Inc.	96	326	4		US	5	f,o,x
55=	WSP Graham plc	96	650		0	UK		b,s
57	Gannett Fleming, Inc.	94	1444	28	2	US	8	a,b,c,d,e,h,n,s,x
58=	Informes y Proytectos S.A.	80	250	6	10	Spain	4	f,s,x
58=	Buro Happold	80	230	4	7	UK	3	a,c,e,g,h,j,l,p,r,s,t
58=	Fugro N.V.	80	4200	21	170	The Netherlands	12	x
58=	Tyréns	80	300		0	Sweden		a,b,c,e,f,h,j,m,n,p,q,s,t
58=	Norplan A/S	80	550			Norway		a,m,n,s
63=	CTI Engineering Co. Ltd	73	916			Japan		b,n,s
63=	Assmann Beraten + Planen GmbH	73	401			Germany		a,b,c,e,f,g,h,m,n,p,q
65=	Oscar Faber Group	70	750	12	8	UK	6	a,c,e,f,h,j,l,m,n,o,p,q,t
65=	Tractebel Development	70	400	11	1	Belgium	7	a,b,c,d,e,f,g,h,j,n,o,p,q,s,t
65=	Delta Projektconsult Projektierungs-GmbH	70	120	3	5	Austria	3	c,g,h,j,p,q,s
68	Technoprojekt A.S.	66	223	2	1	Czech Republic	1	b,d,e,h,k,n,q,r,s
69=	Moe & Brodsgaarg A/S	65	105	2		Denmark	3	a,b,c,e,f,h,k,n,s,x
69=	Africon Engineering International (Pty) Limited	65	1200	20	10	Republic of South Africa	5	a,b,c,e,f,g,h,j,p,q,s,t,x
71	Skilling Ward Magnusson Barkshire Inc.	64	97	1	0	US	3	a,b,c,e,f,g,h,p,t,x
72=	Weidleplan Consulting GmbH	60	420	11	13	Germany	6	a,c,d,e,f,g,h,j,l,o,p,q,t
72=	Nissoken Architects & Engineers	60	230	9	1	Japan	5	c,e,f,g,p,x
72=	Magnus Malmberg Consulting Engineers Ltd	60	60	1		Finland	1	c,e,g,h,k,l
72=	MAA Group Consulting Engineers	60	550	1	7	Hong Kong	4	a,b,c,m,p,s,x
72=	Consulting Engineering Services (India)	60	1200	15	5	India	3	a,b,c,e,f,g,h,j,m,p,q,r,s,v,w
77	Bullen Consultants	59	440		0	UK		a,b,e, f,h,j,m,n,p,s,t
78	Nihon Sekkei, Inc	58	676	10	4	Japan	11	a,b,c,e,f,g,h,j,k,l,m,n,o,p,q,s,t,x
79=	Metroprojekt Praha a.s.	57	162	1	0	Czech Republic	2	b,c,n,p,q,s
79=	Carter & Burgess, Inc.	57	11058	22	2	US	7	a,b,c,d,e,f,h,j,l,m,n,q,s,t,x
79=	Daniel Mann Johnson & Mendenhall	57	1500	20	5	US	12	a,b,c,d,e,h,k,m,n,o,s,t,x
82=	National Engineering Services Pakistan (PVT) Limited	55	2333	5	5	Pakistan	3	a,b,c,d,e,f,g,h,j,k,l,m,n,o,p,q,r,s,t,u,w,x
82=	Sweco AB	55	1497			Sweden		a,b,c,h,j,m,n,p,s,t
82=	Leohardt, Andrä und Partner	55	155			Germany		b,c,e,f,h,p,t
85	Obermeyer Project Management GmbH	54	750			Germany		a,b,c,e,f,h,j,n,s,t
86	Sir William Halcrow & Partners Limited	51	2205	18	20	UK	7	x

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n = Railways
o = Research facilities
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r = Rivers/coastal
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t = Sports stadiums
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1997 Rank	Firm's name	Total structural engineers worldwide	Total staff worldwide	Total national offices	Total international offices	Country	Fee band (US$m) – see key	Sectors – see key
87=	Skidmore Owings & Merrill	50	700	5	2	US	6	c,e,g,j,l,m,o,p,q,r,t
87=	BKS (Pty) Limited	50	1400	18	7	Republic of South Africa	4	b,c,d,e,f,g,h,p,q,t
87=	Keramoprojekt Praha a.s.	50	120	1		Czech Republic	1	c,h,p,q
90=	Rust Kennedy & Donkin	46	1050	13	5	UK	7	a,b,c,d,e,h,n,p,r,s,w,x
90=	TAMS Consultants, Inc.	46	450	10	16	US	5	a,b,d,e,m,n,r,s,v
92=	Earth Tech. Inc.	45	1800	38	2	US	12	a,b,c,d,e,f,h,n,s,
92=	Ishimoto Architectural & Engineering Firm Inc.	45	377	6	1	Japan	6	c,e,f,g,h,j,k,l,o,p,q,t,x
92=	VBK Consulting Engineers	45	61	1		Sweden	2	a,c,e,h,m,p
92=	Wilde & Partners	45	45	1		UK	1	h,j,o,p
92=	C.P. Kukreja Associates Pvt. Limited	45	280	1		India	4	c,e,g,h,j,o,p,x
97	Kume Sekkei Co. Limited	43	718	7		Japan	10	c,f,g,j,l,o,p,t,x
98	Reid Crowther International Ltd.	42	502			Canada		a,b,m,n,p,s
99=	Stanley D. Lindsey & Associates	40	80	2		US	2	b,c,e,f,g,h,p,q,t,x
99=	SSOE Inc	40	560	4		US	6	b,c,d,e,f,g,h,j,k,o,q,s
99=	Leif Hansen Rådeivende Ingeniorer	40	65	2	1	Denmark	2	c,h,p,x
99=	Brian Clancy Partnership	40	110	5	0	UK	2	a,b,c,d,e,f,g,h,j,k,l,m,n,o,p,q,r,s,t,x
99=	JMK Consulting Engineers	40	70	3		Hong Kong	2	b,c,e,g,m,n,p,q,s
99=	KWI Architects, Engineers, Consultants	40	70	2	2	Austria	2	c,e,g,h,p,q,
99=	Bhagwati Designs Private Limited	40	140	3		India		c,h,p,x
99=	Albert Khan Associates, Inc.	40	326	2	0	US	4	e,f,h,k,o,x
107	Richard Weingardt Consultants, Inc. (RWC)	39	58	1	0	US	2	a,b,c,e,f,g,h,j,o,p,q,s,t
108	Shirish Patel & Associates Consultants Limited	36	100	1		India	2	b,c,g,h,n,p,
109	Achammer-Tritthart & Partner, Architekten und Ingenieur	35	350	2	2	Austria	4	c,f,h,,q
110	PCG Profabril Consulplano Group	34	752	17	13	Portugal	6	d,k,l,o,p,t
111=	Leslie E. Robertson Associates	32	47	1	0	US	1	a,b,c,e,f,g,j,k,l,o,p,q,t
111=	Rutherford & Chekene, Consulting Engineers	32	65	2		US	2	a,c,e,f,h,k,l,o,p,t,x
113	Hayes, Seay, Mattern & Mattern, Inc	31	425	10		US	4	b,c,d,e,f,h,l,o,s,u,x
114=	Mason Pittendrigh	30	66	5		UK	2	b,d,e,f,g,h,j,n,o,p,s
115=	Cheshire Engineering Consultancy	30	140	1		UK	2	b,c,e,p,q,s
115=	Crone & Koch Consulting Engineers	30	180	6		Denmark	3	a,c,e,f,h,l,p,
115=	Sposjprojekt Praha A.S.	30	110	30		Czech Republic	1	d,e,h,q,x
118	Walter P. Moore & Associates, Inc.	29	119	5		US	2	a,b,c,e,f,h,j,k,l,o,p,q,s,t,u
119=	Andrews, Kent & Stone Ltd.	28	75	2	1	UK	3	b,c,d,e,f,g,h,p,q,s
119=	Narmaplan O.Y.	28	35	2		Finland	1	c,d,e,f,g,h,j,k,l,o,p,q,t
121	beg	27	72	1	0	Belgium	2	a,b,c,e,hh,j,l,p,s,t
122=	Mostostal-Projekt S.A.	25	60	2		Poland	1	h,q,r
122=	Sacmag De Mexico	25	120	3	3	Mexico	1	b,g,h,o
124	Juva Consulting Limited	22	35	1	1	Finland	1	e,g,h,q,
125=	Ylimaki & Tinkanen Structural Engineers	21	23	2		Finland	1	c,h,j,p,q
125=	Merrick & Company	21	475	5		US	5	a,d,h,k,n,o,x
125=	Helander & Nirkkonen Oy	21	33	3		Finland	1	e,f,g,h,j,o,p,q,t
125=	Thomas Garland & Partners	21	50	2		Republic of Ireland	1	aa,c,e,f,h,j,p,q,x
125=	Holmes & Narver Inc.	21	1200	17	3	US	12	a,b,c,d,h,m,n,o,s

Counting the cost

Hanscomb has been voted the structural engineers' favourite cost consultant. Here the firm provides some statistical unit costs of interest to the profession from its international cost data files.

It is interesting that under normal circumstances, structural costs around the world tend to exhibit a degree of consistency when expressed as a percentage of the overall building cost. This occurs despite the range of labour and material costs, local preferences and procedures. However, as we are all aware, circumstances are not always normal and their consistency can be skewed by a number of factors. These can include basement depths, sophistication of the mechanical and electrical systems, quality of the exterior closure and in more recent years, the degree to which the structure is expressed as part of the design rather than merely supporting the function.

When design teams are putting their fees together we are often asked for our opinion as the percentage split of the projected costs between the various disciplines. When providing these percentages there is a need to take into account the building type and the factors mentioned previously, but as a guide the percentage to the structure for various building types is shown above. Some countries however, such as Germany, do have set fee scales.

Airport terminals	15-20%
Apartments	15-20%
Parking structures	65-70%
Underground parking	70-75%
Auditoriums	20-25%
Hospitals	15-18%
Hotels	15-20%
Offices (excl. tenant work)	20-25%
Schools	15-20%
Retail	20-30%
Multi-screen cinemas	18-22%

Each country varies in its preference for structural systems and selecting a system that is not in line with general practice can increase construction costs. For example, the French preference is for a concrete frame whereas in the US, steel currently holds sway. In Abu Dhabi, concrete is preferred but neighbour Dubai, prefers steel.

Although there is a degree of consistency in the percentage of the overall cost of building, there can be substantial differences in the labour and material costs and in-place costs between countries. There is no such thing as a common unit rate for formwork or reinforcing steel. In the US formwork is a large part of the cost of a concrete structure, where in some developing countries it is so low that it is included in the cost of the concrete unit rate.

Hanscomb regularly measures construction prices in several countries around the world on a quarterly basis. The table below provides the most recent responses we have received from our March 1997 Survey for a selection of structural components.

Notes:

The prices quoted include trade contractors' overhead and profit, but exclude general contractors' mark-ups, general conditions or preliminaries.

1 Excludes foundations and grade slab. Prices are based on a small low-rise office building with poured reinforced concrete structure, with the exception of the US, Australia and Japan, which are priced using steel.
2 These are all-in unit rates for industrial building construction inclusive of material, labour and equipment, formwork and reinforcing steel.
3 Excludes any applied finishes.
4 a & b include local taxes and delivery to site.
5 a, b, & c include all fringe benefits and represent total cost to contractors, but exclude trade or general contractors mark-ups.

For further information please contact Tom Wiggins at Hanscomb in the US toll free at 1-888-442-6726.

Location	Currency	Current exchange rate to US$	1 Building structure m^2	2 Concrete in foundations m^3	3 Grade slab m^2 tonne	4 (a) Ready mix concrete m^3	4 (b) Structural steel per hour	5 (a) Structural steelworker	5 (b) Carpenter per hour	5 (c) Labour per hour
US	US$	1.00	150	563	38.79	80.34	1,113.95	65.77	44.29	38.10
FRANCE	FF	5.80	1,1505,100	275.00	484.00	5,686.00	139.14	139.14	107.33	
GERMANY	DM	1.70	630	835	100.00	180.00	1,950.00	66.11	67.12	52.89
RUSSIA	US$	1.00	171	590	65.00	135.00	2,400.00	20.32	20.32	12.16
SPAIN	Pta	145.00	20,000	9,250	5,950.00	9,650.00	98,000.00	2,198.00	2,460.00	1,960.00
SWEDEN	Kr	7.90	2,200	4,585	350.00	770.00	5,650.00	207.00	207.00	200.00
UK	£	0.62	242	368	18.12	48.32	635.00	10.57	10.57	7.05
CANADA	$C	1.38	173	425	32.00	105.00	1,760.00	41.21	39.45	35.31
MEXICO	pesos	7.90	467	1,534	141.50	487.00	3,820.00	16.64	16.64	8.99
AUSTRALIA	$A	1.28	430	844	80.00	115.00	1,105.00	29.00	29.50	27.50
JAPAN	Y	125	52,000	89,900	4,330.00	9,630.00	41,850.00	2,575.00	2,660.00	1,895.00
INDIA	Rs	35.00	4,200	8,730	1,115.00	4,000.00	18,500.00	n/a	25.00	15.00
BRAZIL	R	1.06	121	278	21.00	98.00	650.00	4.60	4.25	2.95

The Arup archipelago

For four years running Ove Arup & Partners has been voted the world's favourite engineering consultant by the readers of World Architecture magazine. Principally a structural engineering consultancy, the Arup organisation is immensely more than that. Its array of engineering talent constitutes a general purpose reservoir of know-how that is without parallel anywhere in the world. Arup is a unique, self-organised entity that has glided adroitly to the front rank of world technological expertise in the second half of the twentieth century. This profile of the firm by Martin Pawley – the first to appear in a World Architecture survey, and the first of a series of specialist profiles scheduled to appear in future surveys – is a tribute to Ove Arup & Partners. It features a snapshot of the firm's extensive operations in Hong Kong, and a series of 14 interviews and teleconferences with key personnel based in London and New York. Wherever fortune leads Arup in the twenty-first century, its 5,000 engineers won't be wrong.

Arup in progress all over the world. The second phase of the Kuala Lumpur light rail transit system under construction, Malaysia 1996

Modest though its outward manifestations might seem, the Ove Arup Partnership is one of the greatest concentrations of technical expertise in the world. A firm of consulting engineers of truly global reach and awesome range of capabilities it is headquartered in a cluster of 14 nondescript offices in the London Borough of Camden. The firm was founded 50 years ago by the eponymous Ove Arup, a structural engineer of Danish extraction born in 1895 who made a name for himself before the Second World War through engineering and contracting work with pioneer Modern architects. Today he is best remembered for having designed the structure for Berthold Lubetkin"s double spiral ramped Regent"s Park Zoo Penguin Pool, as well as the London reinforced concrete apartment buildings, High Point One and Two.

After war work involving the design and construction of underground air-raid shelters, large capacity aviation fuel tanks and prefabricated harbours, came the years of postwar reconstruction. In 1946 Ove Arup abandoned engineering contracting and concentrated on consultancy instead, launching the practice that became Ove Arup & Partners. By 1950 the firm was 30 strong, growing in size and importance during the era of high public sector spending on schools, hospitals, housing and universities. In 1963, it spawned its own architectural offshoot, Arup Associates. During the 1950s and 1960s, when half the architectural profession was in the public sector and the other half received half its commissions from it, Ove Arup & Partners' clients included virtually every architectural practice of note. A very short list would include the Architects Co-Partnership, Leslie Martin, Michael Scott (who practised in Ireland, where Arup had opened an office as early as 1946), Fry and Drew, Alison and Peter Smithson, Lewis Womersley at Sheffield City Council, Hubert Bennet at the LCC, Basil Spence, Denys Lasdun, Erno Goldfinger and so on.

Maintaining its close connection with avant-garde architecture, the firm pioneered many advanced and economical structural solutions for buildings which remained its core activity. At the same time it began the process of multi-disciplinary working by taking into the partnership specialist engineers from fields such as acoustics, manufacturing, industrial building, transportation, fire prevention and others. Better known for involvement with many of the high profile buildings of the postwar years, Arup has made a name for itself in many other aspects of engineering from roads and bridges, to indestructible flasks for transporting nuclear waste.

Vastly enlarged over the last 30 years, Arup now has over 4,800 employees worldwide and an annual turnover nearing £200 million. It has more than 60 permanent offices in over 50 countries and projects under way in many more. Although not the largest engineering firm in the world, the Arup organisation represents a tremendous concentration of technical and strategic knowledge. Perhaps one telling indicator of the firm's status among its peers is the fact that it is the only foreign firm of engineers licenced to practice in Japan. Increasingly it seems that, whatever the problem, whatever the challenge, Arup has the brain power, the expertise, the technical resources and the global reach to solve it.

A word with the Chairman

Dr Duncan Michael, Chairman, Ove Arup Partnership

Duncan Michael has a curious way of talking. Fast, amusing, slightly menacing in its unpredictability. Interviewed in his office in one of the more impressive Arup buildings overlooking the paved vastness of Fitzroy Square, he adopts a confrontational position: sitting across the conference table and inviting questions like a boxer goading his opponent into a rash move. Come on, is that all you've got? Hit me again.

The present chairman of the Ove Arup Partnership joined the firm at the age of 25 in 1962. Rising rapidly through the organisation he soon became an engineer, not so much famous among architects, as famous within Arup for his strategic vision. He was the man who set up a permanent office in Hong Kong in the 1970s, accessing the whole of East Asia, and set up offices across the United States ten years later. More recently he is credited with having steered Arup's joining the private finance initiative consortium to build the £3,000 million Channel Tunnel Rail Link – taking an equity stake in this way being a new departure for the firm. By means such as

Arup offices worldwide

Graphic representation of the Arup organisation showing global reach

these he is also credited with having played the key part in doubling the firm's profits from £2.8 million (US$4.5 million) in 1995 to £5.6 million (US$8.9 million) last year, thereby signalling Arup's final escape from the British construction industry recession of the early 1990s. Under the Arup constitution he has only a year to go as chairman of the firm, but can be re-elected for two more years. Admired as a manager and an administrator, far from hitting him again, no one has hit him yet.

Prior to Britain's general election, Duncan Michael received a letter from the leader of the Labour Party inviting him to make policy suggestions. Given the firm's enormous expertise in every aspect of engineering, planning and environmental design this does not seem an unreasonable invitation. Why doesn't he go along with government or opposition on a semi-official basis?

Duncan Michael laughs. "We take on a lot of public functions already, but a formal arrangement? It is not something at which we are ready to excel. Unless we had a chance of doing it very well it is not a path that we would wish to follow. Our knowledge is technical and economic. Although we are very aware of the social and environmental impact of our work, we are engineers not politicians. We pride ourselves on excellent work, on proper relations with our clients, on our concern for the long-term health of the firm... That and our sometimes dangerous lack of fear!" And he laughs again.

What then does the future hold for Arup. Will the firm downsize? Will it grow bigger? Will it diversify even further than it has? Does it plan a flotation on the stock exchange?

Michael smiles again. "We couldn't float, even if I wanted to. Who wants the burden of being the servant of someone else's capital? OAP is a private unlimited liability company, owned by restricted trusts. It would take a complete reorganisation of the constitution to go public. As for the other ideas, Arup is a living organism, it evolves and changes with the times. We plan within a framework but have a culture of opportunism."

Is there no danger of Arup being taken over by somebody else, the way Kajima took over Hellmuth Obata & Kassabaum in the United States?

"Several firms have made approaches to join up with Arup over the years, both foreign and British. They don't find it easy to approach us because they don't understand the culture of the firm. We are not a quoted company. The owning trusts are extremely low profile. We don't set out to own our buildings. There are only two things we can do with the money that we earn, other than hold onto it: we either pay it to ourselves or reinvest it in new technology. We reinvest quite a lot of it. We buy computers and software the way other people buy sandwiches."

"We pride ourselves on excellent work, on proper relations with our clients, on our concern for the long-term health of the firm... That and our sometimes dangerous lack of fear!"

Ove Arup Partnership will not be pigeonholed. It evades classification with consummate skill and avoids risky associations. Though Arup contributes to Friends of the Earth it declined to produce a paid report for Greenpeace. Why? Because there was a risk of selective quotation afterwards. Instead they were given some advice for free so as to point them in a correct direction. This defence mechanism is almost instinctive. Whenever an outsider starts talking about the firm in terms of how big and powerful it is, Arup persons immediately start stressing their individuality and independence, their down-home roots in Fitzrovia and the personal relationships with their clients that they build up. Start talking about Arup as though it is a small family firm based on personal relationships and you are given the opposite impression. Out they come with banners waving. All you hear about then is their visionary founder, their 4,800 employees worldwide, their annual turnover of £200 million (US$300 million), their 60-plus offices in more than 50 countries, and their work in every continent on earth.

Is the real secret of Arup's success the long exposure of the firm to social cultures of the fast-growing Asian economies?

"Why should that help?"

It teaches you not to be afraid of blind diversification.

"Our founder Ove Arup was always very interested in the East," Michael begins seriously, but then he adds; "he always liked to eat with chopsticks," which is true but also a joke.

"No, Arup has been working in the East for a long time," he resumes. "We have been 25 years in Hong Kong. We were too late there for the public buildings boom, but we were just in time for the private sector property booms. Now more than 600 of us work there. As for further diversification, there are only so many directions in which we can move at once. It's an interesting problem."

Duncan Michael indicates his need for paper and pencil and, finding these, sketches six circles on it. In the middle is a circle with many small circles inside it. It looks like Gruyère cheese.

"This is Arup today," he says, pointing at the cheese. "Our best activity is still building engineering, but each of these rings represents another specialism. We do civil engineering, transport, industry, products, planning, offshore, power, environmental, research, acoustics, car shells, earthquake, fire, facades, IT, communications and many other things as well. Of course this means we are highly diversified, but I don't see that as a nett weakness. It is a tremendous advantage. It means we have passed critical mass in that respect and now we are big enough for the spin-offs from all these different specialisms to feed into one another in a very productive way for our clients. Diversification is how we have developed in the past, and I think it is how we will grow in the future."

"The question that concerns me is, which new areas do we want to move into in 2005, 2010, 2015 and so on. Construction – that is becoming building contractors ourselves – is one possibility, but I think we can rule that out. As long as we stay on the knowledge side of the process we may only be selling software in 20 years. We will still be there, even if the construction process is completely automated by then. Becoming developers ourselves is another possibility, but I think we can rule that out too. That leaves project management, new technology, finance and education. All of those are interesting. We already spend £500,000 (US$800,000) a year on supporting courses, exhibitions and awards in education. If you ask what new division I would like to have in Arup in 2015 I would have to answer: working with young people, engineering education."

On to factory-made homes

Dr. John Miles, director

"What I am going to do is to ask you to suspend the baggage of the status quo in your minds," says John Miles, head of the Advanced Technology Group, at the beginning of his exceedingly persuasive lecture on the mass production of modular housing, "and concentrate instead on what is possible in the future." He then goes on to demonstrate how the house building industry could be revolutionised if only it could jettison its ancient on-site methodologies and turn to the methods of the motor industry instead. To prove his point he contrasts cars of the 1950s with cars of the 1990s, and houses of the 1950s with houses of the 1990s. The first shows a rapid and undeniable evolution towards less material, lower cost and better performance – the second, an addiction to the methods of the past.

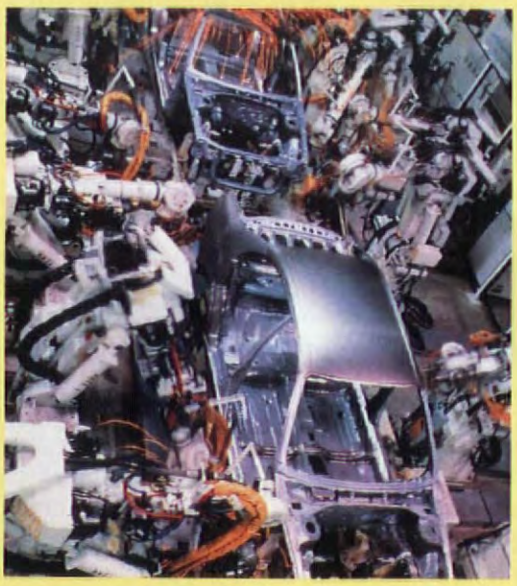
The crusade to achieve what the prefabrication pioneers of the 1940s and 1960s failed to do – produce low-cost, high-performance dwellings on a production line – is now at a delicate stage. The Advanced Technology Group has developed a lightweight concrete housing system that gets away from what Miles regards as the principal failing of earlier architect and construction industry-led prototypes by refusing to consider treating structure in isolation. Their system combines structure, services, interior fit-out and delivery in one single process. Just like the motor industry in fact.

On the face of it, a system like this seems tailor-made for Britain's present housing policy, with its emphasis on a return to the cities with small apartment units and a much more intensive use of waste urban land, but is it technically feasible or socially acceptable? Miles is in no doubt.

"In this country today the McDonald's chain can open a restaurant from the first spade-full of earth dug to the first burger sold in 19 days," he recounts tellingly. "In the United States there is already a large modular housing industry that can sell houses, finished internally as well as externally and delivered to the site for £16 (US$25.00) a square foot. In Japan advanced technology modular housing is so developed that there are models that have 52-square-metre clear-span living spaces. All of that development has come out of production thinking akin to the motor industry's. This sort of housing is designed to be made like motor cars and commercial vehicles. Why can't our housing be like that?"

Reviving the idea of industrialised housing is only one of John Miles's interests at Arup. One of the youngest main board directors in a firm that often seems a veritable power-house of new ideas, he insists that almost any technological project can be pursued at Arup. "As long as the firm stays on an even keel financially, people here have the freedom to pursue what interests them. It's the best place in the world for active minds."

Miles's group at Arup has become a leading authority on the computer analysis of impact and safety issues for the nuclear industry, with Miles taking part in public inquiries as an expert witness. Soon it became plain to them that their methods could be applied in other fields. As he remembers it today: "We decided to offer our services to a wider clientele and that was when I first discovered that other industries were not as insular as the construction industry. Although we struggled for 18 months, the motor industry eventually responded very favourably and we were soon working on the computer analysis of vehicle impacts. Next came the design of crumple zones for Networker trains, the behaviour of aircraft landing gear on impact, and the forging of turbine blades, all of which turned out to be analytically related. Those impact studies led to the application of the same advanced analytical approach to earthquake impacts on buildings, and thus a useful return to Arup's core business, which is structural engineering. It was the experience of all that synergy at work that led us to turn ourselves into the Arup Advanced Technology Group that we are today."



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1: John Miles's current efforts are directed towards applying the methods of the motor industry, as seen here on an automated production line at the Toyota plant near Derby, to the production of housing

2

2: The stacked "parcels" are steel framed, internally fully finished student housing units for Cardiff University by Trinity International

Intelligent buildings

William Southwood, director

One of Arup's leading experts on intelligent buildings is Bill Southwood, a fifty-something Australian engineer with greying curly hair who leads the Information Technology and Communications consultancy group. Southwood joined the firm in 1981 after considerable experience in the communications field including a tour of duty as director of telecommunications to the government of Papua New Guinea, and a period spent researching low-cost communications systems for developing countries. His experience includes all aspects of information and communications system planning, design, contract administration, project management and operation. His contribution to the study of the impact of information technology on buildings has been highly influential and he believes passionately in the role intelligent buildings have to play in the survival of cities into the next century.

Southwood has his own index of the impact of information on the design of buildings in recent years. He draws attention to five major penetrations starting with voice systems, which have now encompassed call centres and telesales operations, some of which operate across time zones. Next he itemises electronic data transmission, the volume of which is endlessly increasing while demand for more data shows no sign of slowing down. He then argues that electronic text and graphical communication has tremendously expanded the world of the printed word through the Internet and the World Wide Web. At the same time the office environment is changing to adapt to the use of video telephony and video conferencing, both of which have acoustic implications for office workers. Finally he cites the impact of mobile communications, almost exclusively the preserve of law enforcement and the armed services until the 1980s, but now universally available. Mobile telephones have made peripatetic working common and reduced the importance of office location, while mobility within large floor plate offices themselves is set to increase with greater use of wireless radio and infra-red control systems.

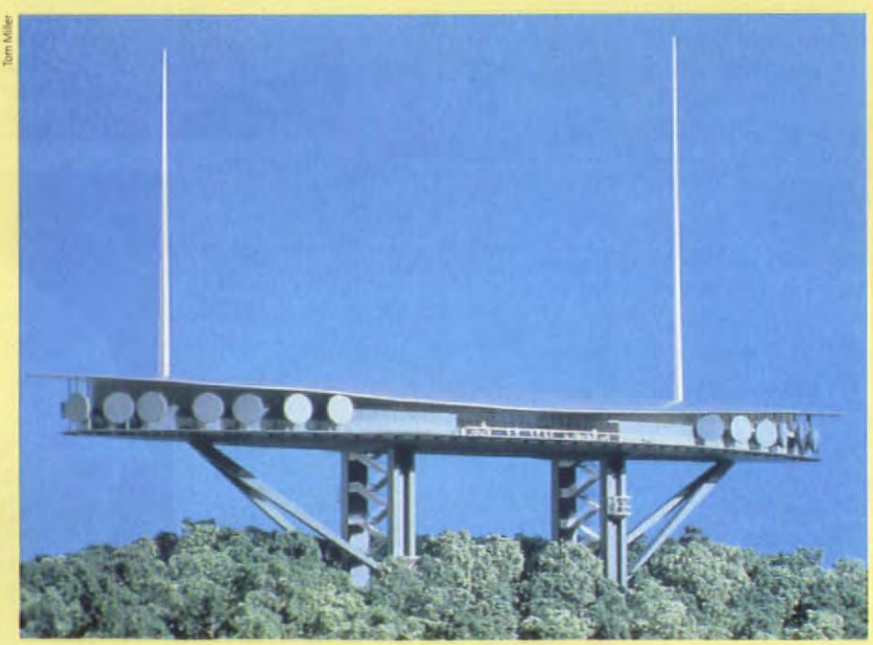
Taken together, Southwood argues, these innovations have laid powerful new demands upon the conventional office building. Routes, risers, cabling, satellite dishes and equipment all have to be housed with careful consideration at an early stage of design. Next engineers will need to know the power consumption, heat dissipation, earthing and electromagnetic compatibility of all equipment before it is installed. Ironically, while the cost of information technology is reducing, demand for it is increasing, so that more and more of it is being installed in the same space.

Southwood sees no problem with this, but he deplores the failure of today's commercial office developers and property agents to come to terms with it.

"The underlying problem," he says, "is that too many people don't understand the growing importance of operating cost, as opposed to capital cost, so the chief benefits of a properly designed intelligent building are not recognised at an early enough stage. One well-known developer recently raised a laugh when he said that he would only consider his building in a prominent London development intelligent if it actually went out and found its own tenant! In fact of course, once you include cost-in-use figures in budgets, you can immediately see the advantage of spending more money above the ceiling and under the floor, and thus getting a longer useful life out of your building."

Looking into the future, what does Southwood see? He considers carefully then answers; "I think there will be no let up in the tendency to accumulate more and more IT capability as long as its cost continues to fall and the equipment itself goes on miniaturising. Believe me, it can go on getting smaller, the only fundamental limitations being the size of a molecule and – at least for keyboards – the width of the human finger. I think the design emphasis has to be on increasing the adaptability of the building. I think truly intelligent buildings will have to be completely computer modelled before they are built. They will be designed as thoroughly as the Boeing 777 was – and that flew 14 months of virtual sorties across the Atlantic before a single rivet was driven to make a real one."

"I think there will be no let up in the tendency to accumulate more and more IT capability as long as its cost continues to fall and the equipment itself goes on miniaturising."



Tom Miller

3: The design of Sir Norman Foster's telecommunications tower at Santiago de Compostela, is a monument to maximising functional requirements within striking architecture in the hi-tech age

3

Taking geometry beyond Cartesian squares

Cecil Balmond, director

Ove Arup & Partners has a long history of involvement with avant-garde architecture stretching back to the involvement of the firm's founder with the circle of Modern pioneers working in London before the Second World War. This tradition was dramatically renewed in the 1960s when the firm took over the difficult task of designing a workable structure for the visionary Sydney Opera House designed by the Danish architect Jørn Utzon. In the 1970s Arup engineer Peter Rice, who had worked on the Sydney Opera House, took over the same task for the architects Renzo Piano and Richard Rogers with their competition-winning design for the Centre Pompidou in Paris.

Today's version of these celebrated architectural challenges is presented by a new generation of avant-garde architects like Rem Koolhaas, designer of the Art Gallery in Rotterdam and more recently the "flying" villa in Bordeaux; Matthias Sauerbruch, architect of an impressive naturally ventilated building in the Potsdamerplatz in Berlin; and Daniel Libeskind, architect of the proposed extension to the Victoria & Albert Museum in London. All three of these designers, along with many others, have made their way to the door of Arup structural engineer Cecil Balmond whose territory has become, first understanding, then nurturing, and finally perhaps building the, at first sight, unbuildable projects of the European avant-garde.

"As I recall it now," he says, "I became very conscious of the sameness of modern and high-tech buildings in terms of their structure at that time. Everything structural was the same. Either vertical or horizontal members, exactly as it had been for the last 70 or 80 years. With very few exceptions, structure in building engineering had become purely a matter of repetition."

The only people trying to break out of this pattern, as Balmond looked about him, seemed to be young architects, who felt the same constriction as he did.

He admired the work of Rem Koolhaas, Toyo Ito, Enric Miralles and Daniel Libeskind, who had just won the competition to design his Holocaust Museum in Berlin. Balmond set up Arup offices in Spain and Germany, and it was while taking an interest in Europe that he began to become Arup's structural engineer for many young European architects, starting with Rem Koolhaas.

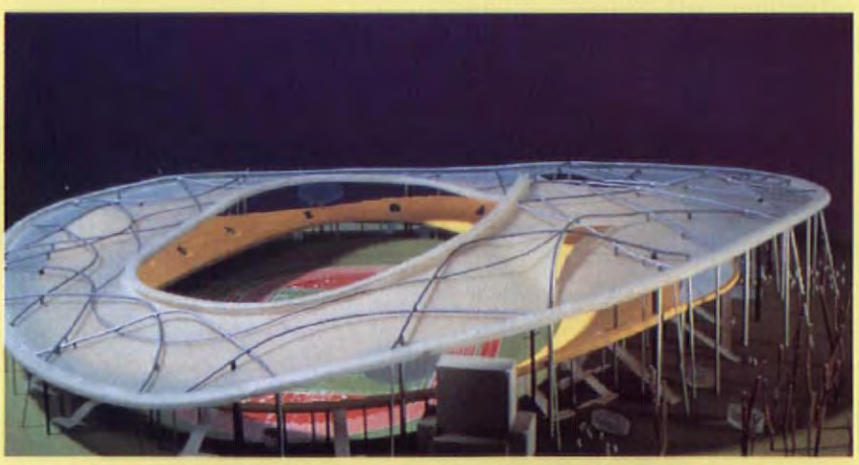
Working with Koolhaas on various competition schemes gave Balmond the opportunity to break away from standardised rectangular office buildings with structural service cores. Instead he began to design structures where the engineering became fundamental to the architecture.

"The standard product at that time was slab, column and bracing core, where most of the building's structure was lost in partitions or hidden by false ceilings when the building was finished," he recalls. "Over half a building's budget is engineering of one kind or another. Imagine engineering design hidden in there for the rest of its life! I was against that. I began designing structures where the bracing had a certain ambiguity, where it was distributed through the building, not confined to the perimeter or the core. Where the expression of the engineering was the architecture."

One of Balmond's most expressive designs, the asymmetrical roof structure of his 1996 project for a sports stadium at Chemnitz, by the German architects Peter Kulka and Ulrich Konigs, is based on cantilevered elements intersected by transverse, torsional and flexural elements creating a free random geometry – glory, as he puts it, "in the resurrection of a geometry that is not confined to Cartesian squares." Another, the well-known Daniel Libeskind project for an extension to the Victoria & Albert Museum in London, achieves a similarly unorthodox response, using planes of structure intersecting at seemingly random angles. Impossible to design only ten years ago, even with computers, Balmond believes that the irregular column spacings and jagged shapes that he can structure now, are capable of injecting a dynamism into architectural space that humanity has never experienced before.

But can the term dynamism really be appropriate where the space-enclosure itself, however radical, is condemned to remain static? Balmond pauses.

"Today our materials are conventional but our 3-D ideas of self-generating geometry is already revolutionary," he says. "The morphology of materials might make real dynamism possible in a few years. We shall see. It will depend on our young architects."



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1: The structure of the proposed Chemnitz stadium illustrated in model form here, was developed from the image of a forest of trees supporting the sky

2

2: The proposed extension to the Victoria & Albert Museum in London designed by Daniel Libeskind represents a new dynamism in structural engineering. Coloration of model shows computed stress levels in the structure

The future of natural ventilation

Alistair Guthrie, director

3: The Helicon office building by architects Sheppard Robson showing Arup active facades

Uncontroversial as it might sound to people brought up in ordinary houses with opening windows, natural ventilation has become a hot potato in the world of commercial architecture. The reasons are twofold. First, environmental problems with refrigerants are making air conditioning systems more problematic than they used to be. Second, building occupants, increasingly condemned to spend their days staring at computer screens, are beginning to demand personal control over their immediate environment. Put these factors together and you get a new enthusiasm for natural ventilation, together with what Arup mechanical engineer Alistair Guthrie insists is a new concept of comfort, and a new approach to the designing of buildings as well.

"Natural ventilation," he explains, "is a continuation of the Modern architectural tradition of getting light and air into the heart of our buildings. That doesn't mean making them uninhabitably hot or cold, as some claim. It means making them adapt to climatic changes, instead of being condemned to one fixed environment year in year out. The difference comes from our capacity as engineers to be specific about different environments in different parts of a building at different times of the year. Natural ventilation means a broad-band definition of comfort, and in providing that comfort, the task of the heating and ventilating engineer is becoming much more that of a building physicist. In effect we are extending our work from designers of air conditioning systems, into integrated facade engineers. Natural ventilation homes in on the barrier between inside and outside, the barrier between the two. In the sense that we concentrate on that, we are as involved in the design of the building as the architect is."

Guthrie sees himself as a contender in what has become an international contest to produce economic zero energy buildings capable of self-sufficiency.

"To move towards zero energy," he insists, "we have to use the envelope of the building itself to control its interior climate. This may not reduce the capital cost of the building, but if we can get comfort conditions by engineering the envelope instead of by burning fossil fuels we will be able to make an enormous reduction in its life cycle operating cost and its environmental performance. That is our goal at present."

"Natural ventilation," he explains, "is a continuation of the Modern architectural tradition of getting light and air into the heart of our buildings"

Guthrie's most recently completed building is the Helicon, a glass-clad financial services building in the City of London designed by architects Sheppard Robson. With 11,000 square metres of office floor space above two basement and three above-ground retail floors, this building is representative of the new generation of mixed-use commercial structures. Arup's contribution was to devise an active, naturally ventilated facade and low-energy building services systems to match the building's state-of-the-art construction. Facade studies produced triple-glazed external cladding with motorised shading blinds between the outer skin and the inner double glazed windows. The low-energy services systems included chilled ceilings to reduce cooling costs together with fresh air floor displacement ventilation. The combination of chilled ceilings, fresh air displacement and movable louvre blinds is energy-efficient, quiet in operation, and inexpensive to maintain.

"The Helicon is an interesting project," explains Guthrie, "because the solutions we devised were based entirely on our ability to analyse in advance the conditions that would arise inside the building. Increasingly this sort of work is about analysis more than it is about engineering systems."

Where does Guthrie think this line of development will lead in the future?

He thinks for a moment. "I don't think engineered systems will ever entirely vanish, but we will go on using technology and analysis to strive to do more with less. I think that for years the principal constraints in building engineering were structural, while building services used to be almost a backwater. The climate, comfort and energy are now the areas which provide the constraints and compromises to the designer. The result has been that the development of building services in its widest sense has become the most challenging contribution that engineering can make to the design of buildings."

Throwing light on the matter

Andrew Sedgwick, director

If diversification is the approved Arup mode of growth, and the way Arup diversifies is by allowing specialist interests to flourish under the umbrella of the firm until they are strong enough to become marketable skills in their own right, then Andrew Sedgwick is an example of just such a skill in metamorphosis. Increasing commercial interest in daylit buildings – as opposed to deep plan structures dependent on artificial lighting – has given the subject a new importance. At the same time rapid development of computer simulation techniques based on finite element radiosity and ray-tracing techniques have made it possible for lighting engineers to model complicated three-dimensional lighting conditions in ways that were impossible even five years ago.

"We are getting better and better at simulating lighting situations. A few years ago we would be confronted with one solution that we would model physically, using an artificial sky. If that didn't work we would alter it until it did. Now we have software that can model 1,000 different lighting schemes, not just under one or two sets of conditions, but under literally hundreds."

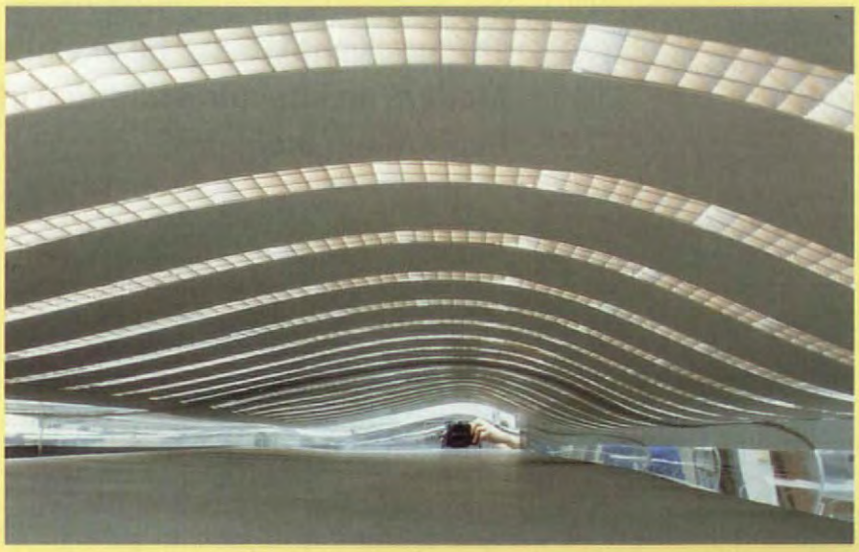
The first time Sedgwick used this technique was with the lighting design of Kansai airport terminal, designed by the architect Renzo Piano. As he remembers the design problem today: "Originally the architect wanted to combine wide strips of rooflight for daylight with very large uplighters to bounce light of the underside of the roof during night-time operations. Because we had new computer equipment we were able to test this configuration with a ray-tracing lighting package, which offered a much more complete simulation than we had ever been able to visualise before. As a result we were able to clearly demonstrate and remedy one or two weaknesses in the design. When cost considerations finally led to the abandonment of the daylighting strips, an alternative was devised without the daylighting panels. The whole experience of working on Kansai showed me the advantages of multi-disciplinary working as a means of achieving design integration – architecture, structure and services – at an early stage. Normally, even now, it is rare for us to be able to use the same modelling software across the design disciplines. Certainly it is very rare for architects to model their projects completely in three dimensions; most still rely on two-dimensional drawings."

Andrew Sedgwick is keen to apply his specialist experience of daylighting using the most up-to-date computer modelling format.

"To do it, all the consultants and suppliers would have to employ the same modelling software and work in what is called '5D modelling' – three-dimensional design, structure and servicing modelling, combined with contract time calculations and cost estimates – but that is still a thing of the future in most cases."

Closer to Sedgwick's ideal perhaps are the car design studios he has worked on in association with Arup's Advanced Technology Group. There lighting is critical because it is used as a means of exposing the rippling, stretching or other imperfections in body panels that can be caused by the forming process.

At present Sedgwick's lighting work is considerably more engineering than interior design. He works, as he puts it, "With architects who know what they are doing", on complex problems involving the integration of natural and artificial light. Recent projects have included work on the Walsall Art Gallery, Cy Twombly Annex in Houston and the new Ben Gurion airport in Tel Aviv. His current project is the Herzog and de Meuron conversion of London's Bankside power station into the Tate Gallery of Modern Art. On this job he is working with a mixture of physical and computer modelling using a special software package that will produce photometrically correct computer graphics. As he points out, "We have to have this because conventional computer graphics, which are widely used to create perspective images of a design, use approximate lighting effects. What we create are synthetic images that have accurate light values and are, therefore, photometrically correct. Much more valuable and much more difficult."



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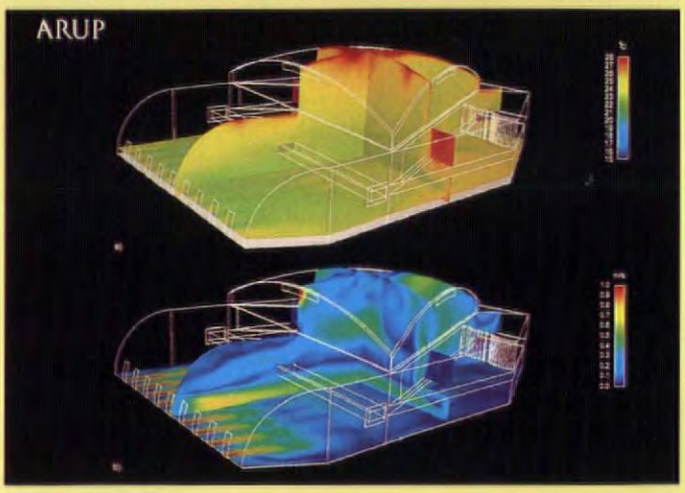
1: Lighting model studies for Renzo Piano's Kansai airport terminal carried out in 1990. The strip rooflights were later abandoned for cost reasons

2: Computer modelling of temperature and velocity at Bluewater Shopping Centre, Dartford, Kent



2

On the trail of smart materials

Steven Groák, director

Steven Groák occupies a position that many thoughtful persons in the construction industry must envy. At a time when long-established public and private sector research organisations have been starved of funds and in many cases disbanded altogether, he is director of the 35-strong research and development group with a budget of £2.5 million a year (US$4 million), working for one of the most advanced multi-disciplinary engineering consultancies in the world. As a result he enjoys unique opportunities not only to look into the future, but to initiate and collaborate with studies that will exercise a powerful influence over its shape. With a polymathic background in architecture, building, planning and economics – Groák modestly describes himself as "the generalist of the R&D group" – he is ideally suited for his role as supervisor of a group of miscellaneous engineers, scientists and specialists. Their combined job description extends from providing technical support across the wide range of skills exercised by the partnership for its clients, through technical intelligence gathering, documentation and specification writing, to general construction industry liaison work.

A fluent man in his early fifties, Groák swiftly outlines the remarkable scope and surprising transferability of some Arup research, explaining that much "project-based" research is carried out on Arup projects generally with the R&D Group often assisting this work, but that the Group's role flows from the more general approach of the firm to deliver high quality engineering design to its clients – and innovating where it is best to do so.

Investigations into the structure and methodology of spider's webs may be well known in science, but other fields are less so. "We have found uses for remarkable computer simulations," he remarks. "When our Advanced Technology Group found out that Sheffield University medical school had simulated the beating of the human heart, we found their results helped more general studies of large-scale non-linear analysis problems. In the same way research into natural construction had yielded the possibility of a selective membrane technique where embedded fine tubes of liquid resin can release their charge if the concrete, and hence the tubes, is broken.

Apart from the general development of "smart" materials, over which Groák and his group maintain a watching brief, he has a multiplicity of other research interests. Merging the latest communications technology with upgraded site operatives' clothing is one, being undertaken in association with Arup Communications, so that individuals can be reached by radio and instructed by head-up displays. Another concerns the rapid development of lift technology in the service of very tall buildings, much of which is taking place in Japan.

Groák strongly feels that an important aspect of the Group's role is the dissemination of new ideas and technologies and helping to realise them around the firm, whether generated within the Group or by other engineers, either inside or outside the firm.

Another of Groák's more long-term preoccupations is the study of natural engineering, a field where advances have already been made in areas extending from studies of human and animal bone structure as an inspiration for the design of large engineering structures, to the potential uses of micro-organisms within inert materials, and the development of rigid semi-permeable membranes that might one day ape the capacity of the animal world and provide buildings with active, self-regulating skins capable of combining the variability of natural ventilation with the performance of air conditioning. The commercial application of such ideas, as he concedes, may be 15-20 years ahead, but he sees definite signs of their feasibility.

"We have already seen projects for passively dehumidifying facades which employ membranes that are selectively permeable to moisture in the manner of green plants. As a result of its material properties we can exploit the facade's modulation of energy and humidity to provide internal comfort. As for commercial feasibility, in a quite different area companies are already taking out 30-year contracts to purify polluted landfill sites by microbial means. We may not know all the answers yet, but I think we already know the tools we are going to use to find them out."

The green lift of the future

3: The green lift of the future. The evolution of lifts has profoundly influenced the feasibility of very tall buildings. Arup R&D is exploring linear motor lifts, in which the cars can move sideways so that multiple cars can use a single shaft, as well as smart card controls, interactive displays and fully transparent enclosures

3

Hong Kong: don't think 1997, think 2007 and beyond!

Today Arup has approximately 4,800 employees worldwide and an annual turnover in excess of £200 million. A company with global reach, operating on every continent, Arup has more than 60 permanent offices in over 50 countries and is deeply involved in building engineering, civil engineering, industrial engineering and a number of other specialist skills. For some time, its largest overseas office has been Ove Arup & Partners Hong Kong – a place about to become part of China.

Circling above the islands clustered round the north bank of the mouth of the Pearl River, waiting to land at a crowded Kai Tak airport, gives a visitor to Hong Kong a grandstand view of an urban civilisation without parallel on earth. Below, the North coast of Hong Kong Island is as densely packed with skyscrapers as cigarettes in a packet, while its hinterland is dotted with massive evidence of earth movement and landfill. In fact, heavily built-up as the coastal strip either side of Hong Kong harbour is, it is not the most obvious topographical feature. That honour falls to the ubiquitous evidence of excavation to be seen in the landscape itself. Everywhere on the Kowloon peninsula and in the New Territories there are great cuts and scars, as though carving knives had been applied to the sides of hills and mountains to reshape them for the new age the former British colony will enter on July 1st 1997.

Slope stabilisation, as this cutting and formation work is called, like the work of tunnelling, bridging, road building and the reclamation of more and more land from the sea, is part of Hong Kong's ceaseless search for building land. It is an illustration of the way in which the Territory has grown up with an almost total dependence on engineering of one kind or another. For nearly 50 years, since the postwar period when the population rose from 600,000 in 1945 to 2.1 million in 1950, survival in Hong Kong – from the water supply that now copes with a population nearly tripled again, to the glistening office towers and the eight sprawling container ports that serve the Territory's booming economy – has depended on engineering skills stretched to their limit. From the closing of the frontier with China in 1951, through the *détente* of the 1980s, right up to the imminent handover to China, Hong Kong has had no other recourse than technology. Look at it from the air today and you

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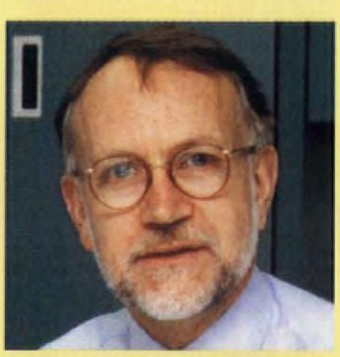

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"Hong Kong business life is dominated by property development, which in its turn is dominated by the extraordinarily high price and scarcity of building land."

1&2: Andrew Chan and Peter Ayres, directors of Ove Arup & Partners Hong Kong

3: Night-time view of skyscrapers on Hong Kong Island

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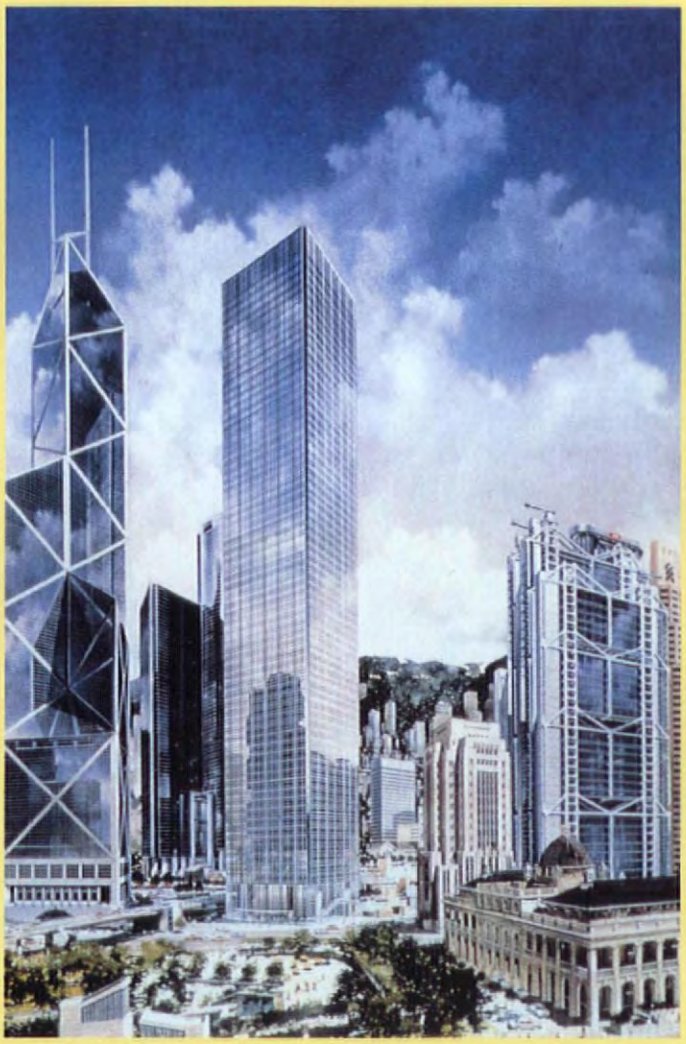
4: Kowloon Station cut and cover tunnels under construction. Four railway tunnels plus ventilation tunnels and sidings

5: Central Plaza, Wanchai (Ng Chun Man & Assoc Architects). The tallest reinforced concrete building in the world on its completion in 1992

can see that Hong Kong is a civilisation sustained by engineering.

Ove Arup & Partners, structural engineers, first came to Hong Kong on a permanent basis at the beginning of 1976, to supervise the Hopewell Centre armature, for which the London office was carrying out the main design. An ambitious and unorthodox commercial development in Wan Chai, it was designed by the architect Gordon Wu, who as one of Hong Kong's leading entrepreneurs remains a client of the firm more than 20 years later. More concrete than glass in appearance, as befits its period, the Hopewell Centre is a 64-storey reinforced concrete tower with a retail podium, an example of the archetypal Asian mixed-use formula that has since been exported all over the world. Anchored to Hong Kong Island's bedrock, the Hopewell Centre rises to a revolving restaurant and a penthouse apartment 215 metres above pavement level on its north side, yet so steep is the slope of its site that its south side entrance is on the seventeenth floor. Because the complexities of this building are mostly hidden, and because the centre of gravity of high-rise construction on Hong Kong island has now moved further west, the Hopewell Centre is often ignored in surveys of the city's skyscrapers. This is unfortunate because it remains a daring and innovative structure, distinguished by its circular plan with structure radiating out from a triple concentric reinforced concrete core slip formed at the rate of four days per floor, a rate of construction still considered fast. This core holds all the building's servicing functions: lifts, stairs, toilets, plant rooms and risers, with the circulation corridors and offices outside it, supported by radiating beams and perimeter columns restrained by ring beams at every floor. Last but not least, when it was opened in 1980, the Hopewell Centre was the tallest tower in Asia.



1: The New Peak Tower by the Terry Farrell Partnership. Structural, M&E, and geotechnic engineering by Arup

2: Artist's impression of the new 62-storey Cheung Kong Centre designed by Cesar Pelli, presently under construction on the site of the demolished 1962 Hilton Hotel

"When banks charge $HK 2 million a day in interest, speed of construction and maximum floor area are vital. Things happen very fast."

› During the construction of the Hopewell Centre the Arup office in Hong Kong doubled in size every year. By the time the structure was finished the office numbered 60 persons. Arup took offices in the Hopewell building itself in January 1985 and has remained there ever since. With the aid of commissions for the civil and structural design of the Central and Admiralty stations on the new Mass Transit Railway (MTR) underground, and a number of very successful high-density housing developments built above MTR train depots, the firm's workload continued to increase and the office grew larger still. By the early 1990s, further large commercial building projects, notably the 100,000-square-metre Hongkong and Shanghai Bank (1985) by Foster Associates; the 262,000-square-metre Exchange Square office towers (1985), designed by Hong Kong architects Palmer & Turner; the 173,000-square-metre Central Plaza by Dennis Lau and Ng Chun Man – the tallest building in Asia from 1992 to 1996; the 153,000-square-metre Citibank Plaza by Rocco Design Partners (also completed in 1992) and the 40,000-seat Hong Kong Stadium (1994), designed by US architects Hellmuth Obata & Kassabaum, had established Arup as the leading firm of structural engineers in the Territory.

For several years after Hong Kong's new airport was given the go-ahead in 1989, the largest job in the office was the monster Chek Lap Kok airport terminal building, which is to replace the ageing and overcrowded Kowloon airport at Kai Tak in 1998. Now, as the airport project nears completion, it has been succeeded by even larger mass transit schemes for Bangkok, Jakarta and Beijing, the former involving the construction over eight years of 64 kilometres of elevated road and railway with retail or commercial office space beneath. The Beijing project is similar to the previous four railway depots and developments designed by Arup in Hong Kong, but on an even larger scale – the depot covers an area of 1.6 kilometres by 260 metres with developments yielding some 1.2 million square metres of floor space. As a result of long-term projects like these, the firm now occupies almost all of four office floors near the top of the Hopewell Centre with a record staff of 650, making Hong Kong the biggest Arup office outside London.

Like many strategic decisions taken by the firm, the choice of

the Hopewell Centre for its offices appears to have been a wise one. Today, more than 20 years after it was designed, several newer commercial centres have exceeded its height and floor area, but few have led such a charmed life as regards obstruction and overshadowing. Unlike many Hong Kong office towers dating from the 1970s, the Hopewell Centre retains its clear view of Hong Kong harbour. But this happy state of affairs cannot be relied upon to continue. Hong Kong business life is dominated by property development, which in its turn is dominated by the extraordinarily high price and scarcity of building land. For this reason demolition and redevelopment is always a possibility. As Arup Hong Kong Chairman Andrew Chan points out: "Hong Kong is a city where land costs could be three quarters of the cost of development. And when banks charge $HK 2 million a day in interest, speed of construction and maximum floor area are vital. Things happen very fast."

Under such conditions the city can, and has, changed its shape and centre of gravity virtually overnight. The 53-storey twin towers of Exchange Square, in the Central Business District, for example, were in use only three years and four months after purchase of the site. Nearby Citibank Plaza, which has a twin tower design of 37 and 47 storeys, completed in 1992, went up equally fast – in two years and 10 months – its basement excavated "top down", allowing the towers to rise at the same time. An even more extreme example is currently taking shape a mere stone's throw from Citibank Plaza and the Hong Kong Bank sites, where the Hong Kong Hilton (only about 30 years old), has been torn down to make way for the 62-storey Cheung Kong Center tower designed by Cesar Pelli – because today the return on office buildings is more favourable than the return on hotels.

The Chek Lap Kok terminal

Ever since 1993, on typical working days, fleets of diesel powered company boats, launches and catamarans have cast off regularly from various piers around Hong Kong waters and threaded their way west through the crowded harbour. They have no passenger space on deck. Instead, their passengers are confined to utilitarian cabins furnished with hard seating like a school bus. These are the ferries that transported construction staff and visitors to and from the new Chek Lap Kok airport site, a 6 kilometre long by 3.5 kilometre wide man-made island off the Northern coast of Lantau Island, some 40 minutes away. Not until the spring of 1997 did these work boats begin to give place to land transport across the Lantau Link and onto the North Lantau Expressway.

Unlike the timeless water route taken by the service boats, the Airport Link, henceforth the main means of access to the airport site, involves many examples of engineering prowess. Great slices have been cut out of the topography of North Lantau, Ma Wan and Tsing Yi islands to construct a road and rail link that will eventually make it possible to travel from the Central Business District to the airport terminal, via a third cross-harbour road tunnel and two new bridges, in about half an hour by road and in 23 minutes by rail. Perhaps the most spectacular part of this new route completed so far involves the world's longest double deck road and rail suspension bridge at Tsing Ma, which carries a dual three-lane expressway, two mass transit railway tracks below it, and enclosed emergency roads on either side for use in typhoons. Together with the cable-stayed Kap Shui Mun bridge that connects Lantau and Ma Wan and associated viaducts and cuttings, these feats of civil engineering serve as an ›

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3: Hong Kong reinforced concrete 40-storey apartment towers. Queen's Garden 1992 (left) and Dynasty Court (1991) right

4: Model of Chek Lap Kok terminal, completion due in 1998

appropriate introduction to the scale of the airport being built on the man-made island of Chek Lap Kok.

Ove Arup & Partners Hong Kong is heavily involved in civil and structural engineering work associated with the railway link to the airport, although not with the Lantau link bridges themselves. Instead the firm is responsible for the design of five new railway stations on the route, three of which are topped by air-rights developments consisting of retail, residential, office and hotel accommodation with a gross floor area of 1.8 million square metres. Though very much larger, these projects are direct descendants of the combined railway depot and air rights housing schemes designed by Arup in the 1970s and 1980s. The huge total of construction involved in this work dwarfs even the Arup structures at the airport itself, which include the 1.27-kilometre-long, 516,000-square-metre terminal building and its associated 80,000-square-metre Ground Transportation Centre, together with a 260,000-square-metre air cargo building, all designed by architects Foster Asia, with Arup as lead consultant on the latter two projects.

In the spring of 1997 these buildings were all steadily emerging from the chaos of the massive construction site on Chek Lap Kok island. A scene resembling a military encampment with scores of motor vehicles, city block-sized dumps of shipping containers, undistinguished temporary accommodation buildings and wired-off enclosures holding the vast inventory of materials and components required to complete them. The most prominent by far is the terminal building itself.

Although not scheduled to accept passengers until 1998, the Chek Lap Kok terminal building is so vast that parts of it are almost complete while work on other parts has barely begun. The structural concrete work may be well advanced, and much of its tinted glass cladding already in position, but the over sailing steel diagrid roof is still in varying states of completion. In some places it is no more than a skeleton while in others it is finished, inside and out, and already painted. This enormous roof, which was designed by Arup engineers to be assembled from 122 site-welded steel lattice shells, each nearly 1,300 square metres in area, represents the focus of the greatest concentration of engineering design expertise in the building. Given the area that it covers, and its internal and external architectural prominence, it is also the most dramatic element of the design. In devising a structure for it, Arup deployed an expertise that has honed its kit of parts down to an almost unbelievably small range of standard components capable of answering every function. The diagrid roof structure itself, for example, is assembled from thousands of steel beams welded together on site on special jigs at precise angles so as to produce barrel-vaulted 36 metre x 36 metre sections weighing up to 138 tonnes. These are then moved by computer-controlled hydraulic transporters and lifted to their final positions on cast in situ reinforced concrete columns. As Arup engineer Craig Gibbons explains it:

"This is an extremely economical roof. All the structural members are standard 406 UC steel sections delivered, cut to the same length and then welded on site. Because the roof slopes longitudinally as well as laterally, the bolted joints over the supporting columns have been specially designed to absorb large horizontal and vertical tolerances. Another piece of skilful synergy involves the triangular soffit panels that hide the decking. There are thousands of these, nearly all of them in one standard size. They not only fit flush between the structural members but, in other locations, are suspended as daylight and luminaire reflectors, throwing light back up onto the underside of the roof to give a floating effect."

1: Aerial view of "Super Terminal 1" cargo terminal under construction at Chek Lap Kok

2: An artist's impression of the completed Taikoo Shing development

3: Artist's impression of the 46-storey East Jin Jiang hotel, Shanghai, which will be completed this year

4: Artist's impression of Kerry Everbright City, now under construction

Compared to the passenger terminal, the adjacent Ground Transportation Centre has only recently emerged from the ground, its most prominent features in the spring of 1997 being the sweeping elevated rail and road viaducts entering and leaving it. Air Cargo Super Terminal 1 is more advanced. Less dramatic in appearance than the passenger terminal it is nonetheless packed with advanced technology. Planned to cope with an annual throughput of 2.4 million tonnes of cargo, the building is a development of an earlier structure engineered by Arup for Kai Tak airport. Internally it has two centralised automated bulk storage systems serving all levels in the terminal. More importantly it has outrigger automated container storage systems that will provide nearly two kilometres of access to the airport apron, the length of airside interface being the limiting factor in cargo handling speed.

Tall Buildings – including housing

Because Hong Kong has overseen the development of tall buildings more surely than any city outside North America – the city not only has some of the tallest commercial buildings in the world, but the world's tallest high-rise housing – it would be surprising if Arup had not continued to play a significant part in the contest to build higher, which they entered with the 215-metre Hopewell Centre. At present the firm has a structural engineering design group of more than 100 under John MacArthur who came to Hong Kong in 1977 for six months to work on the Hopewell Centre and has remained there ever since. Their tallest housing project so far is Queen's Garden, a reinforced concrete tower rising to 165 metres with a total of 200 duplex apartments in 35 storeys that was completed in 1991. Wind tunnel tested for typhoon resistance at the University of Western Ontario in Canada, the Queen's Garden tower, curved in plan, is strengthened by a complex system of cores and coupled shear walls to reduce movement in high winds. The tallest commercial structure to date is Central Plaza, a 173,000-square-metre office tower designed by Dennis Lau and Ng Chun Man. Completed in 1992 with a total height of 374 metres to the top of its mast, it was for a time the tallest reinforced concrete structure in the world, almost twice the height of Queen's Garden. Because buildings this high were previously thought of as the domain of steel construction, Central Plaza broke new ground for Hong Kong when it employed high strength 60N/mm² concrete in its perimeter columns. Since then several tall building projects have come forward proposing even stronger concrete mixes. The first to be built is an office development at Tai Koo Shing close to the flight path to Kai Tak airport where strict height limits are enforced. This is being constructed using 100N/mm² concrete to a height of 28 storeys with the intention that, when Kai Tak closes down in favour of Chek Lap Kok next year, another 16 floors will be added.

At Cheung Kong Center, which is under construction on the old Hilton Hotel site, high strength concrete is being used in conjunction with structural steel, not so much in the interest of greater height, but because it achieves a 40 per cent reduction in the cross sectional area of structural columns and thus permits great gains in usable floor area. The Nina Tower at Tsuen Wan in the New Territories, originally planned with over 100 storeys, was to have used 100N/mm² concrete together with structural steel in a bid to reach over 500 metres, but this project is now being redesigned as two towers, one reaching 300 metres.

John MacArthur's general view of the progress of high buildings takes all these factors into account.

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1: Chai Wan railway depot with 50-tower Heng Fa Chuen housing estate above, 1982

2: Tsing Yi double deck railway viaduct under construction, 1997

"Reunification with China and access to the whole Pearl River delta suggests an enormous long-term potential for economic growth."

› "There are plans for 400-metre buildings all over East Asia, in Japan, Singapore, Shanghai, Shenzen, Kaohsiung in Taiwan and here in Hong Kong," he says, "and there is no doubt that the well-known problems involved in building high – space-consuming sky lobbies, sway problems and the footprint-consuming need for structural shear strength against wind loadings – can all be dealt with."

MacArthur anticipates that the demand for yet taller buildings in Hong Kong will continue.

"There is still the demand, the crippling shortage of sites and the enormous cost of land. We see projects for 420-metre buildings on 3,000-square-metre sites. And despite the fact that the occurrence of typhoons in Hong Kong makes building movements difficult to control, there is a prestige attached to them. There are more coming up than are already built."

Hong Kong: megapolis of the future

Change is a constant in the life of Hong Kong, and the speed with which modern times fade into history there is sometimes shocking to European eyes. For example the bay where the barges carrying the steelwork for the Hongkong and Shanghai Bank building were unloaded in the early 1980s no longer exists. Filled in to create more land, it is now the site of a small town complete with high rise apartment towers. No doubt the state of mind bred by such metamorphoses goes far to explain why the prospect of Chinese rule occasions so little anxiety today. But perhaps a more compelling reason is to be found in the drive for development that is so strong throughout East Asia, and the promise that it offers for an even more vital economic role for Hong Kong in the future.

Andrew Chan determinedly endorses the optimistic view. Despite mild anxiety about the uncompetitively high cost of providing engineering services in the territory, as opposed to mainland China, he has great confidence in the continuation of a strong market for the firm's services in the future.

"Political issues aside," he points out, "mainland China is now Hong Kong's largest investor. Companies from China are among the major property developers with a stake in almost every sector of the Hong Kong economy. If you match that with Arup's relatively long tradition of working on the mainland – we have designed two large power stations in Guangdong Province as well as a host of tall structures – you will see that the future offers many exciting opportunities for us, provided we retain our superior technical and communication skills, our management expertise and our capacity to work hard."

As is often the case, airport planning calculations provide the clearest indications of how China plus Hong Kong might work out. Even today, limited by its tortuous western approach and single runway, Kowloon's Kai Tak airport is the world's third busiest in terms of international passengers and air cargo throughput. This is because half the population of the world lies within five hours flying time of its runway. Factoring in the two new runways at Chek Lap Kok coming on stream in 1998, and the renewed interest being taken by NASA in the United States in supersonic travel across the Pacific, reunification with China and access to the whole Pearl River delta suggests an enormous long-term potential for economic growth. Calculating forward to the year 2040, regional planners already anticipate the rapid development of an urban corridor reaching from Guangzhou to the former New Territories and Hong Kong itself. Such growth could lead to the creation of a Pearl River delta urban region with a population in excess of 50 million. Anticipations of the amount of engineering work connected with that scale of regional development, together with the construction of up-to-date infrastructure links between China and the Special Administrative Region, and not forgetting the considerable redevelopment and expansion already under way within Hong Kong itself, Ove Arup & Partners Hong Kong looks forward to a new regime and the new century with equal confidence.

Working on a land scale

Lorna Walker, director

Environmental Services is a branch of engineering that has sprung from non-existence to great importance in not much more than 20 years. Today it comprises professional services under more than 30 headings that can involve many branches of Arup. Typical applications include environmental audits and the preparation of environmental impact statements; site and route selection studies; corporate environmental policy advice; pollution assessment, monitoring and control; water quality management; ecological surveys; urban and industrial land reclamation; treatment of contaminated land; waste management and recycling studies; energy recovery systems and landfill design.

At the head of Arup Environmental, the 50-strong group of scientists, planners, engineers and landscape architects that brings all this together, is Lorna Walker, who trained as a chemist and a civil engineer and has been with Ove Arup & Partners for 20 years. In her experience alone "Arup Environmental" has grown out of earlier formations with titles like "Water Group" and "Infrastructure Group". Mirroring these changes, over the years her work has broadened from the design and construction of sewage treatment plants to the whole gamut of environmental consultancy.

Giving examples of the scale and multifarious complexity of environmental projects with which Arup is now involved, she cites the sheer volume of earth being moved in connection with the operation of WENT (Western New Territories) strategic landfill site in Hong Kong – 58 million cubic metres of waste, sufficient to fill from the Thames to Fitzrovia to the height of the Post Office Tower. Another example is the very different, but equally difficult, problems associated with constructing the Channel Tunnel Rail Link from Folkestone to the centre of London through environmentally sensitive, as well as densely populated, areas. Add to engineering-related works of this kind the whole realm of problems connected with reducing air pollution, building on contaminated land, purifying neglected stretches of water, even ensuring the continuity of water supplies themselves, and the much abused word "environmental" begins to regain some of the awesome universality of its original meaning.

Breaking environmental issues down into manageable tasks, is what Lorna Walker's group does at Arup, for the firm will not undertake work that it does not believe it can do well. It is as a result of this concentration upon feasible targets that, where outsiders might see "saving" the environment as a holding action, even a lost cause, Lorna Walker takes the opposite view. She is convinced that pollution can invariably be stopped from getting worse – which is to say it can be contained at its present level – and can often be turned back. "If I did not believe that, I would not be working in this field," she comments.

She sees powerful forces at work on the side of long-term environmental improvements through growing public awareness; a more intelligent legislative framework, led by the European Community; new and improved technological and biological techniques for waste processing; and the "green swell" that is causing many major public corporations to seek "green" credentials as guarantees of public acceptability.

She doesn't think enforcement is the best approach to environmental issues. "Education and time are more important. For example, at Salford Quays we were faced with the task of purifying a number of polluted and impounded dock basins as part of an urban regeneration project. Our solution took two years to show substantial improvements, but now it has been operating for ten years, with the basins used for leisure purposes."

"The long-term answer is bound up with the spread of environmental ideas. I always counsel that environmental questions should be brought to a wider audience, so that the audience becomes better informed. The better informed the audience is, the more likely they are to allow the time needed for the best solution to be found and the most appropriate techniques to be implemented."

3: The enormous size of some environmental services waste disposal projects is illustrated by this aerial view of the 1994 West New Territories landfill site

Listening rather than just hearing

Richard Cowell, principal, Arup Acoustics

"Up until World War II acoustic design was as much a matter of witchcraft as science," says Richard Cowell philosophically in his office overlooking Fitzroy Square. "How a room would perform acoustically was based little on science, more on folklore, with hunches and historic examples of success as the only guides. It was not until the 1940s and 1950s that the fundamentals of good practice were codified, and even then they were less sophisticated than comparable developments in other branches of building science. Today far more people depend on the analysis and simulation of acoustic performance."

Richard Cowell should know, for he has been involved with acoustics since his university days. He formed Arup Acoustics with Derek Sugden and John Martin of Arup in 1980 and since then he has been responsible for a wide range of building and environmental acoustic projects. Operating from the London office, he is now in charge of a group of 30 acousticians from many disciplines.

Typical of the remedial work that Arup Acoustics has carried over the years has been the careful noise suppression that accompanies the installation of building services equipment in sensitive areas of buildings. Another example is the long study of public address systems that followed the King's Cross Underground fire in London. The results of this work are to be seen in a detailed 1:25 scale model of Canary Wharf station on the Jubilee Line extension, which has been used to test the performance of the installation that will be used when the new line opens in 1998.

Given his long experience of acoustic matters Richard Cowell's view of the future of acoustics is surprisingly apocalyptic, for he sees the discipline as being on the brink of a tremendous development into the "auralisation" of our culture, using electro-acoustics to create "virtual realms" using simulated sound.

"In the next century I am sure there will be an unprecedented embracing of electro-acoustics on a very wide scale," he says. "We can develop acoustic environments, inviting our clients to *listen* to our designers. As powerful noise sources have invaded our world, so we have lost the pleasures of listening to our environment, such as horse hooves in Fitzroy Square. Using auralisation, we can create such an aural environment without actually being there. We can walk you through virtual reality representations of our designs with your ears – design through listening."

At present "electro acoustics" accounts for only about 15 per cent of Arup Acoustics' workload, as opposed to 35-40 per cent of more traditional work with architects on the acoustic performance of buildings. Another 15 per cent consist of noise control work related to building services, while the rest is made up of projects connected with outdoor environmental noise, audio visual research, and miscellaneous projects. In the future Cowell expects this balance to slowly change with new technology, under the broader struggle for influence that is taking place between the construction industry professions.

"In the design of a concert hall, for example, we try to enhance what the architect wants in terms of formal design, but also achieve what is required acoustically. Looking back, I would say the architects had the upper hand in the 1960s and 70s, but now things have evened out. Recent UK concert halls from Nottingham and Birmingham to Basingstoke and Manchester illustrate development towards a much better balance of influence between acoustician and architect."

While Cowell argues that at present many designers still restrain the contribution from acousticians, few realise the potential that new auralisation systems can bring to reveal the opportunities for designing with sound. "This is the age of the specialist," he says, "and where acoustics is concerned that means we can create a sound environment that has nothing to do with bricks and mortar. What auralisation really means is that sound systems have already overtaken the buildings that house them. In terms of what they hear, people really can live in their dreams. We can make the connections between our dreams and reality by listening in advance."

1: Built in the bowels of Broadcasting House, London, the new BBC Radio Concert Hall is an acoustic success achieved under difficult conditions

Towards an integrated transport policy

Colin Stewart, director

Like the story of the Channel Tunnel, the story of the Channel Tunnel Rail Link (CTRL) is a long and complicated one, but for Ove Arup & Partners it has elements of simplicity, as Colin Stewart, one of the Arup engineers most closely involved, explains. Seated at his desk he briefly outlines a story in which the firm has come from the status of a spectator, to playing a central role. He begins by describing how Arup put together a special group to look into the project because of widely expressed dissatisfaction with the south London link proposed by British Rail for public sector funding. The Arup group's research soon suggested to them that the chief weakness of this scheme lay in the way that it failed to provide good rail links to the rest of the country, as opposed to London. Lobbying the government on this point, the Arup group recommended an alternative route that swung north of the Thames. When this route was accepted, the rest became history. Like the man who liked the product so much he bought the company, Ove Arup & Partners joined forces with the private consortium that tendered for the £3 billion (US$4.8 billion) job under the British government's Private Finance Initiative, and won it. This was a tremendous victory in Stewart's view. "The project is a prototype for infrastructure in the twenty-first century," he says. "It will not only introduce high-speed rail travel to the United Kingdom for the first time, it will bring about the regeneration of the St. Pancras/Kings Cross area of London and begin a new era in the cooperative financing of infrastructure of all kinds."

Colin Stewart joined Arup in 1977 after studying civil engineering at Nottingham University and gaining experience in the UK and on large-scale road projects in Iran and Saudi Arabia. He has since worked on road, rail and tunnelling projects in the UK and abroad that have involved high levels of computer aided design and management responsibility.

"The key question in large transport projects is one of ownership. Historically, the ultimate client for infrastructure work has been a government body whose focus will tend to be the project's initial cost and this will inevitably have long term disadvantages. That is why I think the Private Finance Initiative represents such an important change. The CTRL project is a world leader in this respect. When undertaking a 30 to 99 year build and operate contract, the operators naturally view the whole of life costings very seriously. They know that whatever they build is going to need ongoing maintenance and the better it is built, the longer it will last. The privately financed infrastructure has already been tremendously influential overseas. East Asia has more privately financed infrastructure being built than any other region; by working there we have learnt much that we have been able to turn to our use in Europe."

Asked to look ahead at what might be achieved in 20 years, Stewart is properly reticent, but he is not without answers. "First I would hope we could have achieved better public transport systems that people actually want to use – as opposed to wanting *other* people to use. Then I would look for indisputably better service, as opposed to declining services. By then I think we will have successfully discouraged personal transport so that it is no longer the stumbling block it is at present, by reconsidering the way people work and want to work and accommodating those changes. To that end I would look to new communications technologies requiring less mobility altogether. Most important of all, I hope we will have all learned to look at transport, not as different and competing systems, but as different parts of the same thing – an integrated transport process."

"I hope we will have all learned to look at transport, not as different and competing systems, but as different parts of the same thing."

2: The Ove Arup Partnership is part of the private finance initiative consortium building the rail link between the Channel Tunnel Terminal in Kent and Central London. Illustration shows route superimposed on satellite map

3: The Bangkok elevated road and train system provides 53 kilometres of dual three-lane urban expressway combined with mainline and local railways – integrated transport in action

From platforms to power stations

John Roberts, director

"When I talk about energy, I am talking about upstream energy, oil and gas exploration and production, power stations and high voltage transmission systems," says John Roberts with a smile. "Buildings are low voltage stuff." After a varied career Roberts is now in charge of Arup Energy. This involves offshore engineering, the construction of power stations – coal fired and gas turbine – as well as submarine and terrestrial pipeline work. All these areas, with the possible exception of the construction of power station buildings, are about as far from Arup's traditional core activity, the structural engineering of conventional buildings, as it is possible to get.

John Roberts joined Arup in 1972; after ten years he changed course away from conventional building and switched to oil and gas engineering instead. He began evaluating concrete structures for the South China Sea, and designing concrete gravity structures and flare and burner towers for the North Sea oil fields. He also worked on the planning and development of onshore oil fields in Southern England. In the late 1980s he was project manager for the design and construction management of the Concrete Gravity Substructure (CGS) for the Ravenspurn North Field, the first such structure designed by a British firm and the first to be installed in the southern North Sea. After that he diversified into power stations.

"There is a big difference between oil and gas and power station work," Roberts explains, "and the difference is largely historical. From day one oil and gas have been mainly private sector industries that cost a lot of money to get into and are dominated by a small number of big competing international clients. Demand for gas and oil has always been high and that has meant that great importance has always been attached to speed and efficiency in the industry. Because of the hostile and unpredictable environment, all offshore engineering is extremely expensive, difficult and very specialised. Offshore extraction is very sophisticated and the industry that supports it is geared to produce custom solutions for particular situations. There is no such thing as a standard product, unless you count floating cranes that cost up to £500,000 (US$800,000) a day to hire. On the other hand, there are rewards for exceptional performance. If you can finish something like a £300 million (US$ 480 million) CGS five months earlier than a competitor would have done, the operator's revenue stream might improve by as much as £50 or 60 million (US$ 80-96 million).

"Power generation, on the other hand, is a very different business. It has, until very recently, always been a public utility with little or no competition. Suppliers of power station equipment like Siemens and GEC ALSTHOM competed on the technical efficiency of their equipment. As a result, it hardly mattered to some power generation authorities how long things took to make or even what they cost as long as it was similar to others. With the deregulation of the electricity generation industry and the beginning of competition all that has changed. As a result prices have dropped dramatically. The capital cost of coal fired power stations was US$1200/KW five years ago. Today the cost is less than US$600. The capital cost of combined cycle gas turbine stations is now less than US$300/KW. As far as power station construction is concerned this reduction has been achieved by a squeeze on building costs and building time. Independent power producers insist on short delivery times. Non-fuel operating costs have been cut to the bone. That means green field sites, rationalised construction, modular components. All the fat is out of the business and everyone wonders how to cut the next US$10 off the capex (capital expenditure). Nowadays if we want to win a job in power generation, we have to be able to do it cheaply and do it fast. That's what we bring to the party."

"If we want to win a job in power generation, we have to be able to do it cheaply and do it fast."

1

2

1: Wandoo, an Arup-designed concrete gravity substructure, under tow

2: Shajiao "C" Power station, completed 1996. The second Arup-designed power station for the Pearl River estuary, China

In praise of tall buildings

Tony Fitzpatrick, director

The subject of tall buildings, which enjoys a fitful popularity in Britain, numbers many enthusiasts in Arup, not least director Tony Fitzpatrick, structural engineer of the 435-metre Millennium Tower project designed by Foster & Partners for the City of London. Fitzpatrick joined Arup in 1972 at the age of 21 and has worked for the firm ever since. From 1982-1986 he worked in the firm's Hong Kong office, chiefly on the structural design of Foster Associates' Hongkong and Shanghai Bank, one of the most innovative high-rise structures ever built. His years in Hong Kong turned Fitzpatrick into a confirmed enthusiast for high-rise construction and, with the passage of time, he has come to see more and more advantages in it. Today he believes that the future of cities in the era of global warming depends on achieving much higher densities and the role of tall buildings in this process seems to him to be crucial.

"We live in a world," he begins, "where the population of Hong Kong is equal to the population of New Jersey, which has 17 times the area. In London, for the proper functioning of the central financial district, we need a density that allows easy corporate interaction, which is why we need a square mile rather than a square *15* miles. Even if we don't consider any other factors than energy and resources it is obvious that tall buildings with large floor plates are the most efficient type for commercial purposes in London. A building like the Millennium Tower, with 2,000-square-metre floor plates, has an immediate 50 per cent operating cost advantage over any number of five-storey buildings with 500-square-metre floor plates. In fact air-conditioned, five-storey buildings with 500-square-metre floorplates are an energy disaster."

Better by far, in Fitzpatrick's view, would be to explore the avenues for more efficient high-rise building that new technology has opened up on a global scale. He himself is particularly keen on the potential of new lift technology and active structures used to minimise structural volume and thus increase the efficiency of taller and more slender buildings.

Nigel Young/Hayes Davidson

3: Computer-generated image of the proposed 400-metre London Millennium Tower, designed by Foster and Partners and engineered by Arup

4: Aerial montage of La Tour sans fins, Paris (1989 project) by Jean Nouvel, also engineered by Arup

"Today the advantages of building high drop off at the lower end if the floor plates are too small, and drop off at the upper end if there is too much structure, too much lift equipment, too many sky lobbies and so on. Realistic high-rise projects stop at 110 to 115 storeys. But now we have faster and larger lifts and even multiple shaft use, where slow stopping lift cars can park outside the lift shaft to allow faster lifts to go by. This shifts the limiting factor back to vibration. Ten years ago that meant that a building's width had to be a sixth or a seventh of its height. Now the use of tuned mass dampers means that this limitation has been removed.

"But what I really want to see happen is for us to be able to use tuned mass dampers not only to control vibration, but to anticipate and counteract all external forces, wind loads, even earthquakes. If a building could actively design out the wind loadings that are applied to it we could have gravity-only design. We could have a building 25 metres square with a column in each corner, any height we wanted. We could have structure with a 100-year life because there would be so little of it you would never have to change it."

"Where is the logic in opposing high-rise in principle? Are we supposed to fossilise? People in the eighteenth century did not try to preserve a seventeenth century environment. Why should we do it now? It's a dead-end agenda. Sometimes I think that engineers have got too far ahead of everyone else."

Industrial engineering

David Whittleton, director

Ove Arup & Partners first became involved with industrial engineering through its structural design activities in areas such as telecommunications towers and offshore facilities for the oil industry. An ever-broadening multidisciplinary skills base then led to success in the energy sector, manufacturing and process plants, and general industrial facilities. Arup is currently involved in industrial projects all over the world – not least in Russia, where it is heavily involved in bringing the volume production of consumer goods to the former Soviet Union for the first time.

Often overlooked in surveys of a firm that is chiefly known for its structural engineering prowess, Arup's Industrial Division, which designs and equips production facilities for demanding clients like Toyota, General Motors, Renault, BAT, Procter & Gamble, Cadbury and Carlsberg, is actually the most globalised branch of the Arup organisation, acting in many countries for multinational corporations and thus working for truly global clients. Furthermore, although Arup's industrial engineering work may often account for less than half of the outturn cost of any of these immense projects, because of its integrated approach to design and management it is also capable of having a significant impact on cost effectiveness and therefore profitability, and repeat business is a key feature of the Division's workload. The Toyota plant at Burnaston, near Derby, for example, involved a total investment of £700 million, of which some £200 million comprised engineering work researched, designed and implemented by Arup.

David Whittleton, director of the London-based Industrial Projects Group and Chairman of the Industrial Division, reflects, "We almost always worked through architects up until the early 1980s. In those days, in the UK at least, many major industrial projects were procured in the traditional manner with the architect acting as project manager as well as overall designer. This worked, of course, but sometimes the facility was not best suited to the client's process and business objectives. Increasingly we were asked to work directly for industrial clients and we found, not surprisingly, that they often see things differently: the buildings themselves are important but secondary to time, cost and productive efficiency, and they see engineer-led projects as better suited to their needs. From then on, we tried to position ourselves in the market as project managers and team leaders, offering everything from strategic advice and analysis to fully comprehensive facilities design, planning and management services. At the same time we broadened our skill base out from building engineering into industry specific areas such as production engineering, materials management, process layout and product design. There is a strong logic to this. In the consumer industries the value of the process inside a factory is usually over half the total investment. In some industries, automotive for example, it can be much higher. Against this background the skill is to achieve quality architecture and building design within appropriate cost, schedule and process constraints."

"We are growing steadily and we will continue to look for new and relevant skill areas, and new territories. We are already working in 15 countries, and the firm's network of offices will help us develop further."

One particular success story is the firm's eight-year old venture into Russia and the other countries of the former Soviet Union, which some may have seen as too risky.

"No other similar operation is as big as we are in Russia today," he says. "We are seen as a major player by the big overseas consumer goods companies that are setting up production facilities there. The reason is partly our skills base and our responsiveness, but we have also built up the knowledge and experience to deal with the unusual code and approvals environment, enabling us to improve cost and construction times. As a result in Russia, since 1990, we have earned £20 million in fees from £400 million of investment. As demand for consumer goods builds up in Russia we expect heavier industry to develop there too."

Beyond Russia, the Division is focusing on the energy sector in East Asia, where the firm's strong and long-established presence is crucial, and on providing a global service to international clients in all sectors. There are still plenty of opportunities to go for.

"Buildings themselves are important but secondary to time, cost and productive efficiency, clients see engineer-led projects as better suited to their needs."

1

1: Toyota car factory, Burnaston, Derby. Designed by Ove Arup & Partners in association with Shimizu UK Ltd. Completed 1992

Arup engineering in New York

Ray Crane, director

Ove Arup & Partners was first established in the United States in 1985 in San Francisco. The New York office opened in 1989. At that time the New York property market was in recession but Arup soon found clients because many New York architects were searching for work overseas. Since Arup already had offices and projects all round the world, several of these architects saw the benefits, in their expansion overseas, in teaming with the New York office. By this means the firm soon attracted a significant number of architectural projects and architects were introduced to the wider capabilities of Arup and the office thrived and began to expand rapidly.

In 1992, Ove Arup & Partners New York also started to offer mechanical, electrical and plumbing engineering services. The marketing of a total engineering design service was then, and still is, unique in New York. Since then the office has continued to expand, becoming the largest Arup office in the US, doubling in size approximately every 18 months. Now its complement stands at just over 110 staff and offers multidisciplinary design services including transportation planning and civil engineering. These base disciplines are augmented by specialist in-house consultants in communications, with acoustics and fire protection promoted but currently supported from other Arup offices.

Raymond Crane, an English expatriate, joined the New York office in the early days, when the search for work was on, a time when the firm was dismissed by some American competitors as specialising in "boutique engineering".

"How I hate that term," he says today, " but I suppose we did do it and we still do when the project is interesting. In the early days we provided architects with specialist structural engineering services as a means of introducing ourselves to New York architectural practices: support for sculptures, interesting residences and competition designs. Our capabilities and abilities have spread considerably beyond these early commissions.

Does the firm suffer from competition from the large American A&E and AEC firms (architecture and engineering and architecture engineering and construction)?

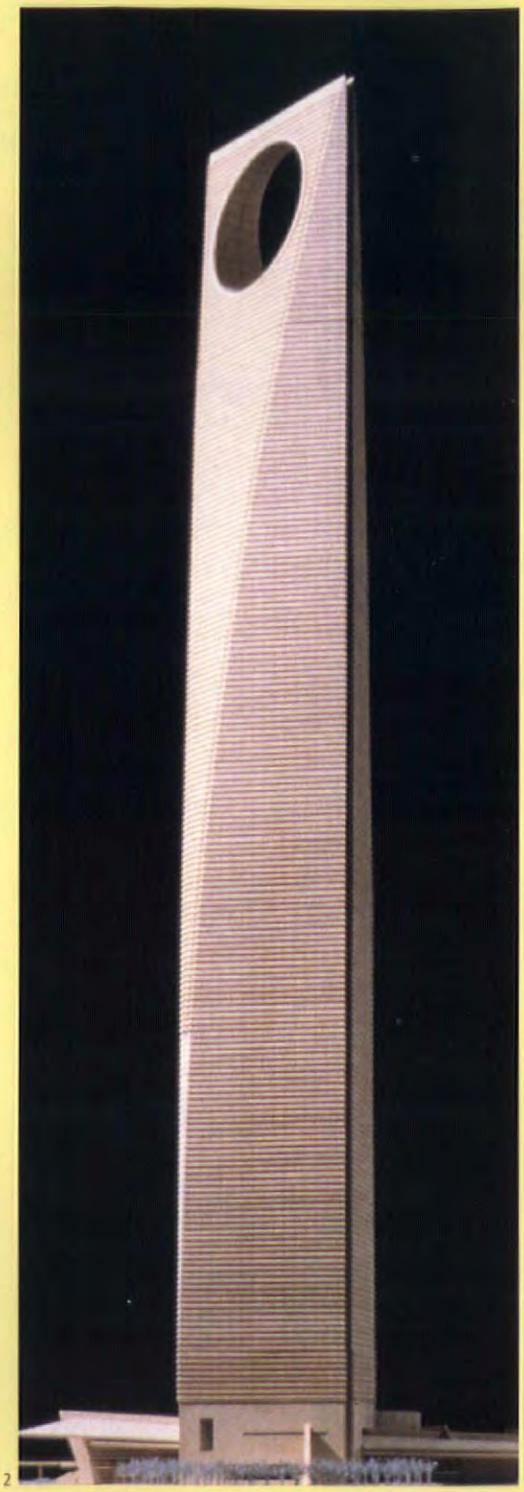
"It has been our experience that the big A&E firms are mostly big 'A' with little 'E' or big 'E' with little 'A', and that doesn't give them the best balance. A strong architecture practice teamed with a good engineering consultant, should beat any A&E firm. But, that said, if a client goes directly to an A&E firm there is very little chance for another engineering firm to participate except possibly by offering specialist skills. Where we think the partnership works best is in competitions. We have gone round the world with New York architects who have won competitions. The fact that we already have such a strong global network is a tremendous advantage. Distance is no object. We work with local architects, they are our local market; where the work is, is another matter."

Where does Crane see Arup developing most in the New York market?

"We have no super high-rise projects on the books in New York at the moment, but there is renewed interest in office building. It would be an achievement to have an Arup building on the famous New York skyline. We are developing a considerable reputation in airports and are currently working as the design engineers for the replacement of the international arrivals building at JFK airport terminal, part of a design, build, operate consortium led by ELCOR/Shipol. This has also opened up civil engineering opportunities with the design of part of the elevated airport terminal roadway. Additionally we are part of a team bidding for the construction of the proposed rail link from downtown to Kennedy, a link that will connect the New York subway system to the airport for the first time. In its entirety that will be a US$1.5 billion (£937 million) project. Beyond that we see high end civil engineering, particularly light rail, as the real growth area. There is much more local and state money available for that."

Like his counterparts in distant London and far off Hong Kong, and probably in the 50 or so countries where the firm is represented today, Ray Crane is deeply optimistic about the long-term future of Ove Arup & Partners.

"I think the prospects for the New York office are good for the same reasons as the prospects for the firm everywhere are good. Ove Arup & Partners has been established for 50 years and has a name that adds credibility to projects it is associated with. It is one of the biggest engineering firms in the world. It has offices in countries in every continent. It has immense and respected reserves of knowledge and power which, coupled with its high standards of service, enable it to continue to advance the arts of engineering. That is all I can say." WA



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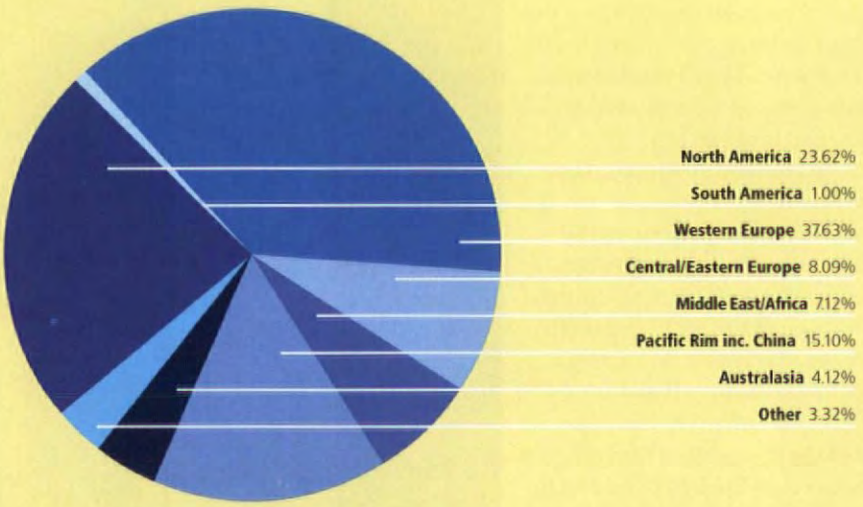
2: The projected MORI building in Shanghai. Arup engineers from the New York office produced a structure for one of the tallest buildings in the world

The shape of the industry

Global trends and averages

Global market by region



Western Europe on top

Western Europe is dominant in this representation of how the international structural engineering market is divided up by national office location.

Whilst national offices in the established economy regions continue to make inroads into emergent foreign markets, it can be seen that the home presence in the Pacific Rim region is already substantial and looks set to grow.

No 1 Lockwood Greene Engineers

The following tables list the top five firms in the six primary regions, assessed by numbers of structural engineers employed

Top 5 in North America	Country	Number of structural engineers employed
Lockwood Greene Engineers Inc.	US	300
Black & Veatch	US	200
Weidlinger Associates, Inc.	US	170
TT-CBM Engineers	US	150
John A. Martin & Associates, Inc.	US	139

No 1 Ove Arup & Partners

Top 5 in Western Europe	Country	Number of structural engineers employed
Ove Arup & Partners	United Kingdom	1,520
W.S. Atkins Architects Limited	United Kingdom	1,058
DHV Beheer BV	The Netherlands	1,000
Mouchel	United Kingdom	771
Carl Bro Group A/S	Denmark	390

Top 5 in the Pacific Rim

	Country	Number of structural engineers employed
China Engineering Consultants Inc	Taiwan	156
The Maunsell Group	Hong Kong	124
Pacific Consultants International	Japan	123
Chung Suk Engineering Co. Limited	South Korea	120
Nikken Sekkei Limited	Japan	104

No 1 China Engineering Consultants

Top 5 in Central & Eastern Europe

	Country	Number of structural engineers employed
IFB Dr. Braschel GmbH	Germany	100
Delta Projektconsult Projektierungs-GmbH	Austria	70
Technoprojekt A.S.	Czech Republic	66
Weidleplan Consulting GmbH	Germany	60
Metroprojekt Praha a.s.	Czech Republic	57

No 1 IFB Dr. Braschel

No 1 National Engineering Services Pakistan

Top 5 in Africa & the Middle East
including India & Pakistan

	Country	Number of structural engineers employed
National Engineering Services Pakistan (PVT) Limited	Pakistan	55
Africon Engineering International (Pty) Limited	Republic of South Africa	65
BKS (Pty) Limited	Republic of South Africa	50
Shirish Patel & Associates Consultants Limited	India	36
Bhagwati Designs Private Limited	India	40

No1 Meinhart International

Only three firms qualified for inclusion in the survey

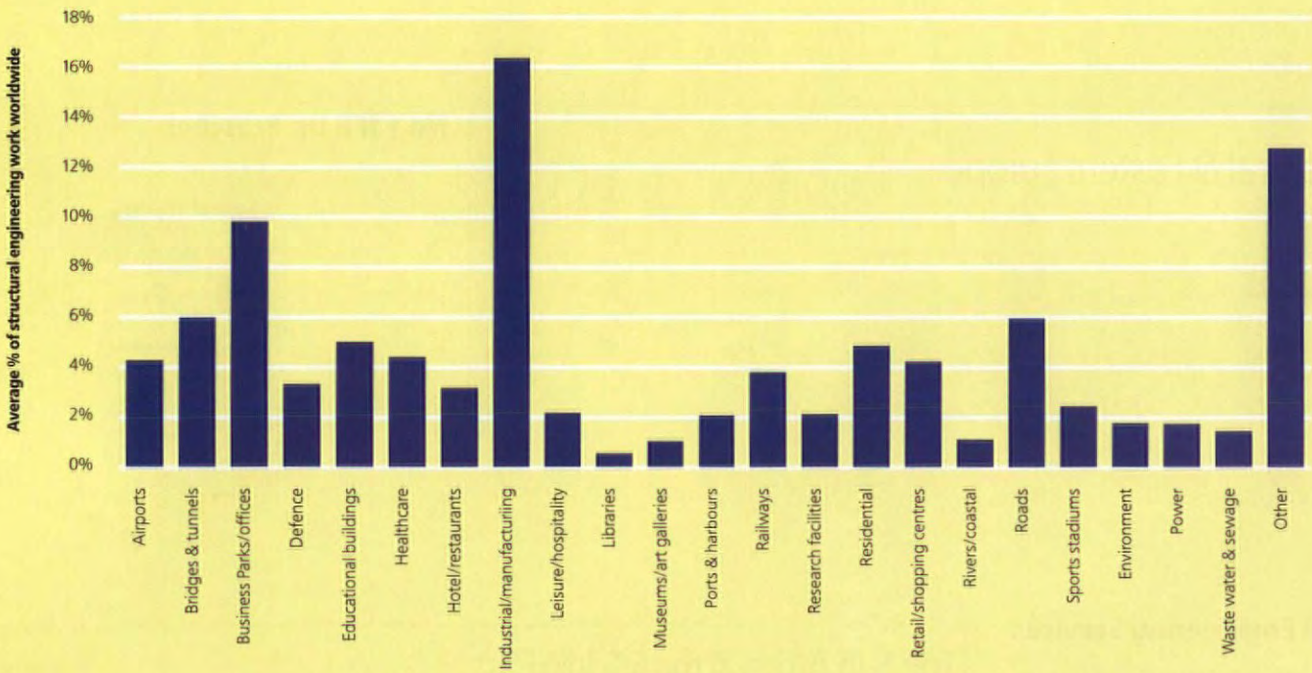
Top 3 in Australasia

	Country	Number of structural engineers employed
Meinhardt International Pty Limited	Australia	300
Beca Carter Hollings & Ferner Limited	New Zealand	160
Connell Wagner	New Zealand	130

Industrial power

International breakdown of work by sector

Global market by sector



Manufacturing a market

Calculated on an average percentage of total structural engineering work, this chart shows a healthy international industrial and manufacturing sector. The 22 categories selected clearly cover most structural engineering activity and the "other" category will be further subdivided in future years.

No1 WS Atkins , UK

UK flying high

By applying the percentage of workload dedicated to a given sector to the total number of structural engineers employed, the following breakdown of top ten firms tables has been compiled sector by sector.

Top 10 in Airports	Country	Estimated structural engineers dedicated
WS Atkins Architects Limited	UK	185.15
Ove Arup & Partners	UK	91.2
Scott Wilson Kirkpatrick	UK	32
Nellemann, Nielsen & Rauschenberger A/S	Denmark	30
Reudel Palmer & Tritton Limited	UK	23.70
Berdal Strømme Q.S.	Norway	22.5
Meinhardt International Pty Limited	Australia	21
Consoer Townsend Envirodyne Engineers, Inc.	US	20
Weidlinger Associates, Inc.	US	17
Scandiaconsult A.B.	Sweden	17.5

Top 10 in Bridges

	Country	Estimated structural engineers dedicated
Mouchel	UK	277.56
Parsons Brinckerhoff	US	84.75
Cowi Consulting Engineers and Planners AS	Denmark	78.2
Weidlinger Associates, Inc.	US	71.4
Scandiaconsult A.B.	Sweden	52.5
Ove Arup & Partners	UK	45.6
Consoer Townsend Envirodyne Engineers, Inc.	US	43
Chung Suk Engineering Co. Limited	South Korea	36
Berdal Strømme Q.S.	Norway	30
Hyder Consulting Limited	UK	28.72

No 1 Mouchel, UK
More than three times bigger in bridges than No 2

Top 10 in Business Parks

	Country	Estimated structural engineers dedicated
Ove Arup & Partners	UK	273.6
Royal Haskoning Group	The Netherlands	70
Meinhardt International Pty Limited	Australia	60
AB Jacobson & Widmark	Sweden	45.5
TT-CBM Engineers	US	37.5
Finnmap Consulting OY	Finland	32
Nikken Sekkei Limited	Japan	27.04
KPFF Consulting Engineers	US	24.2
Cowi Consulting Engineers and Planners AS	Denmark	23.8
Nihon Sekkei, Inc	Japan	22.92

No 1 Ove Arup & Partners, UK
US kept out of the top four

No 1 Ove Arup & Partners, UK
UK takes top three positions

Top 10 in Education

	Country	Estimated structural engineers dedicated
Ove Arup & Partners	UK	60.8
W.S. Atkins Architects Limited	UK	52.9
Harris & Sutherland	UK	30.6
KPFF Consulting Engineers	US	24.2
Meinhardt International Pty Limited	Australia	21
Scott Wilson Kirkpatrick	UK	20
Mitchell McFarlane Brentnall & Partners International Ltd.	Hong Kong	20
Scandiaconsult A.B.	Sweden	17.5
AB Jacobson & Widmark	Sweden	17.5
TT-CBM Engineers	US	15

No 1 HDR, US
WS Atkins close behind

Top 10 in Health

	Country	Estimated structural engineers dedicated
Henningson, Durham & Richardson, Inc.	US	54.72
W.S. Atkins Architects Limited	UK	52.9
Ove Arup & Partners	UK	45.6
AB Jacobson & Widmark	Sweden	24.5
Waterman Partnership Limited	UK	21
Scandiaconsult A.B.	Sweden	17.5
Meinhardt International Pty Limited	Australia	15
TT-CBM Engineers	US	15
Harris & Sutherland	UK	15.3
Stanley D. Lindsey & Associates	US	14.292

Top 10 in Hotels

	Country	Estimated structural engineers dedicated
W.S. Atkins Architects Limited	UK	52.9
Meinhardt International Pty Limited	Australia	30
Ove Arup & Partners	UK	30.4
John A. Martin & Associates, Inc.	US	27.8
Waterman Partnership Limited	UK	24
AB Jacobson & Widmark	Sweden	17.5
TT-CBM Engineers	US	15
Mitchell McFarlane Brentnall & Partners International Ltd.	Hong Kong	15
Harris & Sutherland	UK	15.3
Parsons Brinckerhoff	US	13.56

No 1 WS Atkins Architects

Australia breaks into the top three

Top 10 in Industrial

	Country	Estimated structural engineers dedicated
Lockwood Greene Engineers Inc.	US	240
Ove Arup & Partners	UK	152
WS Atkins Architects Limited	UK	105.8
Coppee-Courtoy (SNC Lavalin)	Belgium	85.5
Aaro Kohonen Oy	Finland	50
Beca Carter Hollings & Ferner Limited	New Zealand	48
Technoprojekt A.S.	Czech Republic	38.28
Wilde & Partners	UK	36
Finnmap Consulting OY	Finland	36.8
Scandiaconsult A.B.	Sweden	35

No 1 Lockwood Greene Engineers

US premier firm takes the lead in industry

No 1 WS Atkins Architects

UK puts emphasis on leisure time

Top 10 in Leisure

	Country	Estimated structural engineers dedicated
WS Atkins Architects Limited	UK	105.8
Ove Arup & Partners	UK	45.6
Harris & Sutherland	UK	22.95
Meinhardt International Pty Limited	Australia	15
Waterman Partnership Limited	UK	15
Nellemann, Nielsen & Rauschenberger A/S	Denmark	10
Oscar Faber Group	UK	10.5
Buro Happold	UK	8
Connell Wagner	New Zealand	7.8
Delta Projektconsult Projektierungs-GmbH	Austria	7

No 1 Ove Arup & Partners

Scandinavia carving out a market

Top 10 in Libraries

	Country	Estimated structural engineers dedicated
Ove Arup & Partners	UK	30.4
Harris & Sutherland	UK	7.65
TT-CBM Engineers	US	7.5
Aaro Kohonen Oy	Finland	5
Moe & Brodsgaarg A/S	Denmark	3.25
Magnus Malmberg Consulting Engineers Ltd	Finland	3
IFB Dr. Braschel GmbH	Germany	2
Leslie E. Robertson Associates	US	1.6
Rutherford & Chekene, Consulting Engineers	US	1.6
Waterman Partnership Limited	UK	1.5

Top 10 in Museums

	Country	Estimated structural engineers dedicated
Ove Arup & Partners	UK	60.8
Buro Happold	UK	16
Oscar Faber Group	UK	7
John A. Martin & Associates, Inc.	US	5.56
Skidmore Owings & Merrill	US	5
Hayes, Seay, Mattern & Mattern, Inc	US	3.72
Cowi Consulting Engineers and Planners AS	Denmark	3.4
Kume Sekkei Co. Limited	Japan	3.01
Magnus Malmberg Consulting Engineers Ltd	Finland	3
Waterman Partnership Limited	UK	3

No 1 Ove Arup & Partners

Japan makes a showing at No 8

Top 10 in Residential

	Country	Estimated structural engineers dedicated
Meinhardt International Pty Limited	Australia	48
Ove Arup & Partners	UK	45.6
Scandiaconsult A.B.	Sweden	42
Finnmap Consulting OY	Finland	32
Cowi Consulting Engineers and Planners AS	Denmark	23.8
JMK Consulting Engineers	Hong Kong	20
Nellemann, Nielsen & Rauschenberger A/S	Denmark	20
Waterman Partnership Limited	UK	15
Harris & Sutherland	UK	15.3
Connell Wagner	New Zealand	13

No 1 Meinhardt International

Top three fight for pole position

No 1 WS Atkins Architects

Ove Arup & Partners are the only firm to appear in every category

Top 10 in Retail

	Country	Estimated structural engineers dedicated
W.S. Atkins Architects Limited	UK	105.8
Ove Arup & Partners	UK	60.8
Waterman Partnership Limited	UK	42
TT-CBM Engineers	US	22.5
Delta Projektconsult Projektierungs-GmbH	Austria	21
Hyder Consulting Limited	UK	21.54
Meinhardt International Pty Limited	Australia	15
Law Engineering & Environmental Services, Inc.	US	14.3
Mitchell McFarlane Brentnall & Partners International Ltd.	Hong Kong	10
Oscar Faber Group	UK	10

No 1 WS Atkins Architects

Bringing the total to five appearances at the No 1 spot

Top 10 in Sports

	Country	Estimated structural engineers dedicated
W.S. Atkins Architects Limited	UK	52.9
Weidlinger Associates, Inc.	US	20.4
Aaro Kohonen Oy	Finland	15
Ove Arup & Partners	UK	15.2
Skilling Ward Magnusson Barkshire Inc.	US	14.72
John A. Martin & Associates, Inc.	US	13.9
Oranjewoud	The Netherlands	10
Mitchell McFarlane Brentnall & Partners International Ltd.	Hong Kong	10
Nellemann, Nielsen & Rauschenberger A/S	Denmark	10
Weidleplan Consulting GmbH	Germany	9

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Head office
1315 Franklin Road
Roanoke, Virginia 24018, US
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Fax: +540 857 3180
email: hsmm@roanoke.infi.net
http://www.hsmm.com

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Southeast US
Charlotte, North Carolina
Florence, South Carolina
Greensboro, North Carolina
Spartanburg, South Carolina
Raleigh, North Carolina
Gulf Coast US
Mobile, Alabama

Size of practice
Engineering staff: 175
Architectural staff: 64
Total staff: 425

Key personnel
T Howard Noel, PE, President and Chief Executive Officer
John P Bradshaw, Jr, PE, Chairman and Chief Operating Officer
Cecil G Doyle, PE, Chief Financial Officer
Stephen P Clinton, PE, Chief Development Officer

Areas of specialisation
Offices and technical buildings
Health care facilities
Prisons and correctional facilities
Museums
Maintenance facilities
Communication centres
Manufacturing/assembly plants
Bridges and highways
Mass transit facilities
Ports
Water supply, dams, impoundments
Water and wastewater treatment plants
Central utility plants
Power supply and distribution systems
Parking structures
Urban planning and development

Practice profile
HSMM is an architectural and engineering firm with a half century of meeting the technical facilities needs of industry and government.

With a staff of 425 engineers, architects, scientists, and support personnel, HSMM provides solutions to problems in building development, transportation, and the environment. The company offers comprehensive engineering and architectural services on a worldwide basis, including projects in north, central, and south America; Africa; the Caribbean; the Middle East; and Europe.

HSMM is organised to provide professional services in seven specific areas of practice, either singly or in combination: transportation, buildings, healthcare, environmental, correctional, industrial, and telecommunications.

Projects
- Design of medical clinic renovations and additions in the Republic of Panama
- Planning and design of 420-bed hospital, including extensive renovations, new 8-story tower and parking garage
- Design of new 200-bed hospital in El Salvador
- Studies and design services at government offices in Sudan, Jordan, Israel, and Austria
- Renovation design of 100,000-square-metre "wedge" of the Pentagon, one of the world's largest office buildings
- Design of innovative off-line sanitary sewage storage facility with 19-million-litre capacity
- Studies, design and construction supervision for the original port and major expansion, Port of Guayaquil, Ecuador
- Location study and design services for 1,446-metre, six-lane segmental concrete bridge over scenic river
- Design and construction phase services for three subway stations, 2.5 kilometres of associated running sections, and 1,000-car parking structure
- Design of state emergency operations centre to ensure survivability and efficient operation of crisis management programme
- Design of campus-style medium-security prison with 1110 beds, medical facilities, food service, prison industries, warehousing, administration and security fencing with guard towers
- Award-winning overhaul of 161-kv power supply system for high technology development complex, including substations, transmission lines and support buildings
- Multiple design projects for a 425-building industrial complex, including laboratories, emergency operations centre, security command centre, hazardous waste treatment facility, and industrial building renovations

CP Kukreja Associates Pvt Ltd (CPK)

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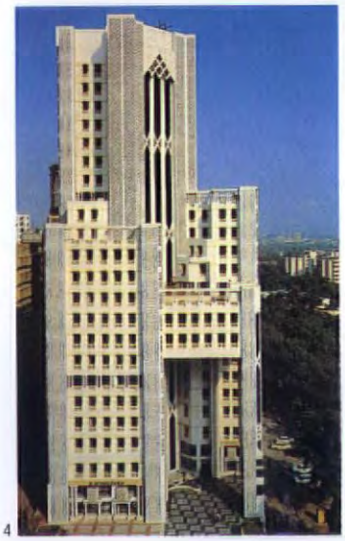

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Head office
Ashirwad, D-1 Green Park,
New Delhi 110016, India
Tel: +91 11 6863953
Fax: +91 11 6865770

Key personnel
C P Kukreja
R K Thareja
S K Nandi
O P Kukreja
Dr P K Magu

Size of firm: 280 employees

Specific past and future projects
Jawharlal Nehru University, New Delhi
National Archives, Janpath, New Delhi
Indian Institute of Management, Lucknow
Indian Foreign Services Group Housing, Delhi
South City, Gurgaon.
Heritage City, Gurgaon
Housing for Air Force & Naval Officers, Mumbai
New Delhi Hilton
Goa Hilton, Goa
Grand Mansion Elotel, East Delhi
Signature Towers
Continental Apollo Hospital, Dhaka, Bangladesh
DCM Daewoo Motors, Delhi
BMW Car Plant, Delhi

Recent clients
The following clients are multi-national companies in joint ventures with Indian firms:
New Holland Tractors, UK & Italy
Smithkline Beecham, UK
Cummins Engine Co, US
Duracell, US
Hero Honda Group, Japan
SGS.Thomson, Italy
Lumax Industries (Stanley, Japan)

Company profile
C P Kukreja Associates Pvt Ltd (CPK) is a comprehensive architectural consultancy organisation established in 1967 and operating out of New Delhi. It has five principals and a staff of 280. Due to the nature of the office set-up, where all professionals work under one roof, all projects are undertaken as one integrated design exercise. The result is a unique blend of design sophistication blended with technical skills. The organisation has an impeccable record for the provision of aesthetically inspiring as well as cost effective structures.

The firm has extensive experience in the design of major projects for most of the pre-eminent public and private sector agencies in India. In addition the firm has worked with clients from US., Canada, UK. France, Germany, Italy, Austria, Finland, China, Japan, Korea among others. Projects have been undertaken in the Middle East, Russia, Nigeria, Bangladesh and Nepal.

Under the leadership and direction of C P Kukreja, the organisation has displayed the ability to expand and deal with projects in increasing numbers, and on a larger and more complex scale without sacrificing either quality or freshness. He is ably assisted by four directors, drawn from different disciplines, who ensure that there is always strong communication and interaction amongst the different sections of the office. The rapidly expanding construction industry in India has seen CPK emerge amongst the front runners in the provision of architectural services to multi-national companies all over the world.

CPK have won several design awards, including the nation-wide design competition for Jawaharlal Nehru University Campus at New Delhi spread over an area of 1000 acres.

Expertise/specialisation
Architecture; town planning and urban design; structural and civil engineering; electrical and mechanical engineering including air-conditioning and FDV system; fire fighting; compressed air and vacuum system; quantity surveying and estimating; plumbing and sanitary engineering; construction supervision and management; landscaping; interior designing

1: SGS Thomson Micro-Electronics, Delhi Entrance view of a high-tech facility for the software development multi-national SGS Thomson.

2&3: Tata Cummins Automobile Engine Plant, Jamshedpur A combination of ceramic tiles and curtain wall system for the facade of this state of the art automotive engine plant. Designed in association with Kevin Roche John Dinkeloo & Associates, US.

4: Amba Deep Towers, New Delhi Located at a prominent road junction in the city centre of New Delhi this 23 storey office building with its exquisitely designed facades using mosaic tiles has become a landmark in the city. A ride in the glass elevators commands a panoramic view of the Central Secretariat Complex of New Delhi.

5: Facade Detail of Academic Schools, Jawaharlal Nehru University, New Delhi. Exposed brick is typical of the JNU Campus. The recessing form is a response to climatic need for shading and also caters to the variegated requirement of different functional rooms on different floors.

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Lockwood Greene

Head office
1500 International Drive
PO Box 491
Spartanburg
SC 29304
USA
Tel: +864 578 2000
Fax: +864 599 4117

National and international offices in:
Aiken, South Carolina, US
Albuquerque, New Mexico, US
Atlanta, Georgia, US
Augusta, Georgia, US
Austin, Texas, US
Buenos Aires, Argentina
Cincinnati, Ohio, US
Cork, Ireland
Dallas, Texas, US
Denver, Colorado, US
Huntsville, Alabama, US
Indianapolis, Indiana, US
Knoxville, Tennessee, US
Lima, Peru
Los Alamos, New Mexico, US
Mexico City, Mexico
Mobile, Alabama, US
Moscow, Russia
Nashville, Tennessee, US
New York, New York, US
Oak Ridge, Tennessee, US
Phoenix, Arizona, US
Pittsburgh, Pennsylvania, US
Raleigh, North Carolina, US
St Louis, Missouri, US
San Juan, Puerto Rico, US
Sao Paulo, Brazil
Savannah, Georgia, US
Seattle, Washington, US
Singapore
Somerset, New Jersey, US
Spartanburg, South Carolina, US
Wiesbaden, Germany

Company profile
Lockwood Greene is a global consulting, design, and construction firm with an extensive worldwide customer base in process and manufacturing industries. Headquartered in Spartanburg, SC, USA, Lockwood Greene maintains 33 offices throughout the Americas, Europe, and Asia, and has annual billings exceeding US$210 million. The corporation is a global business partner for its clients in several industries, including chemicals, foods & beverages, general manufacturing, healthcare products, metals & minerals, microelectronics, telecommunications, and the US Government.

Background
Founded in 1832, Lockwood Greene is one of the oldest professional service firms in the world, its history and growth having paralleled that of the Industrial Revolution. The corporation was acquired in 1981 by Philipp Holzmann AG of Frankfurt, Germany, the largest construction company in that country.

Lockwood Greene began international operations at the beginning of the twentieth century; this business segment now represents a significant part of the firm's overall efforts. To date, Lockwood Greene has completed international projects for more than 200 clients from over 80 nations. The firm continues to play a strategic role in providing innovative solutions to industrial companies worldwide.

Service and strategy
With a staff of over 2,800 consultants, engineers, architects, and construction personnel, Lockwood Greene offers complete services that extend through product development, planning, programmes, project implementation, and ongoing operations. By means of its trademarked Outcomes by Design® process, Lockwood Greene forms enduring business relationships with companies to help them solve problems and achieve competitive advantage.

1: Brown & Williamson Tobacco Company, Macon, GA / US. Atrium toward front lobby

2: General Mills Company, Covington, GA / US. Pipe bridge for utilities infrastructure

3: Globe Manufacturing Company, Tuscaloosa, AL / US. Entrance to admin. Building

4: Spartanburg Regional Medical Center, Spartanburg, SC / US. Patient drop-off

Meinhardt Consulting Engineers

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1: LAR Taikoktsui Station and Tunnel, Hong Kong

2: Pontiac Marina Development, Singapore

3: Peninsula Hotel, Bangkok

4: Rialto Tower, Australia

5: OUB Centre, Singapore

Head offices

Meinhardt (Australia) Pty Ltd
601 St. Kilda Road
Melbourne 3004
Australia
Tel: +61 3 9529 8700
Fax: +61 3 9510 4123
Contact: Mr Graham Suttle

Meinhardt (Asia) Pte Ltd
Level 5, Wah Ming Centre
421 Queen's Road West
Hong Kong
Tel: +852 2858 0738
Fax: +852 2559 1613
Contact: Mr Laurie Smith

Other offices

Singapore
Manila, the Philippines
Ho Chi Minh City, Vietnam
Bangkok, Thailand
Kuala Lumpur, Malaysia
Jakarta, Indonesia
Karachi, Pakistan
Sydney, Australia
Brisbane, Australia
Darwin, Australia

Areas of specialisation

Disciplines

Meinhardt provides comprehensive and co-ordinated consulting engineering services assuring cost effective and environmentally responsible solutions for a range of engineering disciplines including:
Geotechnical; civil; structural; infrastructure mechanical, electrical, hydraulics, fire; building services; project management; building facades; aviation; highways; seismic

Services

Services provided by Meinhardt range from feasibility studies to full design procurement and construction management and include:
Feasibility studies; environmental investigations; economic studies; masterplans; detail design, specification and documentation; tender negotiations; supervision/management of construction; programming; quality assurance and control; procurement; commissioning; post-completion audits; total plant maintenance; value engineering; independent checking and engineering audits

Company profile

The Meinhardt Group is an international multi-disciplinary firm of consulting engineers based in Asia and Australia. The practice provides consulting services in civil, structural, electrical, mechanical, transportation, intelligent buildings systems and related engineering disciplines including project management and building facades.

The Group employs almost 1,000 permanent staff in 12 well established permanent offices in Asia and Australia and these include very skilled and experienced multi-disciplinary engineers, technicians, computer personnel and support staff with a wide variety of international experience gained over many years with Meinhardt.

The Group was founded by our Chairman, Mr W L Meinhardt, in Australia in 1955. In 1973, offices were opened in Hong Kong, Singapore, Jakarta and Kuala Lumpur. Other offices in Asia have been established over the last 10 years.

Meinhardt has a reputation for a practical and workable approach, adapting to local customs and practices while at the same time bringing international expertise and innovation to projects.

Meinhardt has successfully completed numerous and varied commissions throughout Asia, China and Australia covering the full range of consulting engineering and project management services and applications.

Past and future projects

World Square Development, Sydney; Rialto Towers, Melbourne; Queen Victoria Building Restoration, Sydney; Moran Clinic Hospital of Excellence; Sydney Airport Third Runway; MTRC Contract E50 1/E5 18 – Central Station/Siu Ho Wan Depot, Hong Kong; Base Maintenance, Line Maintenance and Aircraft Overhaul Facilities at Chek Lap Kok Airport and Tseung Kwan O Industrial Centre, Hong Kong; Cathay Pacific Airways Headquarters and Crew Hotel at Chek Lap Kok, Hong Kong; MTRC Contract C504/C505 – Kowloon to Taikoktsui Tunnels/MTRC Tai Kok Tsui Station, Hong Kong; Tseung Kwan O 1 9B Residential Development, Hong Kong; Pontiac Marina, Singapore; OUB Centre, Singapore; Bugis Junction, Singapore; City Telecoms Centre, Singapore; Bintan Beach International Resort, Singapore; Peninsula Hotel, Bangkok; World Trade Centre, Colombo, Sri Lanka; The Landmark, Ho Chi Minh City; Plaza Indonesia, Jakarta; Shenzhen Shangri-La Hotel, PRC; Pharmaceutical Plant, Guangzhou, People's Republic of China (PRC); Food Processing Factory, Guangdong, PRC; Shanghai Square, PRC; Detergent Manufacturing Complex, Shanghai, PRC

Mott MacDonald Group

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1: Twickenham Rugby Ground, London, UK

2: East India Dock, London, UK

3: 120 Collins Street, Melbourne, Australia

4: Hong Kong New Airport Terminal at Chek Lap Kok Architect – Fosters & Partners

5: Working model for International Centre for Life, Newcastle, UK Architect – Terry Farrell and Partners

Head office:
St Anne House
20-26 Wellesley Road
Croydon CR9 2UL
Surrey, UK
Tel: +44 181 686 5041
Fax: +44 181 681 5706
email: mike.barker@mottmac.com
Web: www@mottmac.com

National and international offices
Offices in 20 UK locations and 50 countries worldwide

Key personnel
Mike Barker, Fred Tall, Tim Dawson, Ric Auger, Alan Clark

Size of firm
4400 staff

Company profile
Mott MacDonald is one of the world's foremost multi-disciplinary engineering consultancies. We have a strong portfolio of projects both at home and abroad from landmark headquarters for international organisations to single-storey buildings for private individuals.

Our track record worldwide gives us the technical and managerial expertise to lead and coordinate multidisciplinary teams on major building and infrastructure projects such as Hong Kong's new airport passenger terminal. Backed by the very latest in computer technology, we have all the design skills and experience necessary to achieve elegant, economic and exemplary buildings. Right from the start of conceptual design, we pay special attention to optimising buildability and value-for-money while meeting our client's specific needs.

Areas of expertise
We pride ourselves on innovative and cost effective structural solutions for all types of projects. Our capability spans all sectors of the market including retail, commercial, industrial, institutional and leisure. In addition we have specialist skills in multi-storey structures, airports, building maintenance, foundations and geotechnical engineering.

Past and current projects
International Centre for Life, Newcastle, UK
Boots HQ, Nottingham, UK
No 1 St. James's Square, London, UK
Agriculture House, London, UK
Motorola ECID, Swindon, UK
Royal Mail Railnet hub, London, UK
Hong Kong's airport passenger terminal
Twickenham Rugby Ground redevelopment, London, UK
Downshire Square, Bracknell, UK
National Library of Wales new building, Aberystwyth, UK
School of Ocean Science, University of Wales in Bangor, UK
Valley Park leisure complex, Croydon, UK
Brooklands Healthtrack, Surrey, UK
Watchmoor Park, Surrey, UK
LEGOLAND® Windsor, UK
33 Old Broad Street, London, UK

Recent clients
BAA plc (British Airports Authority), Motorola, Boots, Legal & General, World Bank, BAT, Abbey National, SPP Investment Management, Helical Bar, Averley Wood Properties, Royal Mail, LEGO®, National Westminster Bank, British Airways, Rugby Football Union and British Telecom

Tractebel Development / Tractebel Engineering

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1: Indosuez Bank Headquarter

2: Citibank Building

3: Sozacom Building

4: Brussels International Airport

Head office
Avenue Ariane, 7
B-1200 Brussels
Belgium
Tel: +32 2 773 75 11
Fax: +32 2 773 79 80
Telex: 21.852 TRACT b

Number of employees
Tractebel Development:
300
Tractebel Engineering:
2,400

Areas of specialisation
Tractebel Development specialises in the group's engineering work in:
- Building development
- Regional and urban development (water supply and treatment, urban sanitation, public transport systems, infrastructure equipment, roads, planning)

The Building Development Division comprises *Tractebel Engineering's* know-how in the following sectors:
- Office buildings
- Shopping centres
- Universities and training centres
- Hospitals
- Laboratories
- Computing centres
- Industrial plants
- Hotels, housing and tourism development
- Urban and military development

Company make-up
Tractebel Development is a subsidiary of the industrial group Tractebel SA, renowned world-wide for its experience in the design, construction and management of works in the public, energy, communications and industrial sectors.

Tractebel has participated in works in Africa, Latin America, eastern Europe, the Middle and Far East as well as on the home European market. Tractebel's involvement in more than 70 countries world-wide has enabled it to reach and maintain its ranking among the ten foremost engineering companies in the world. Over the years, Tractebel has gained the recognition of, and obtained registration with, the main international bodies and has successfully completed many consultancies financed by them.

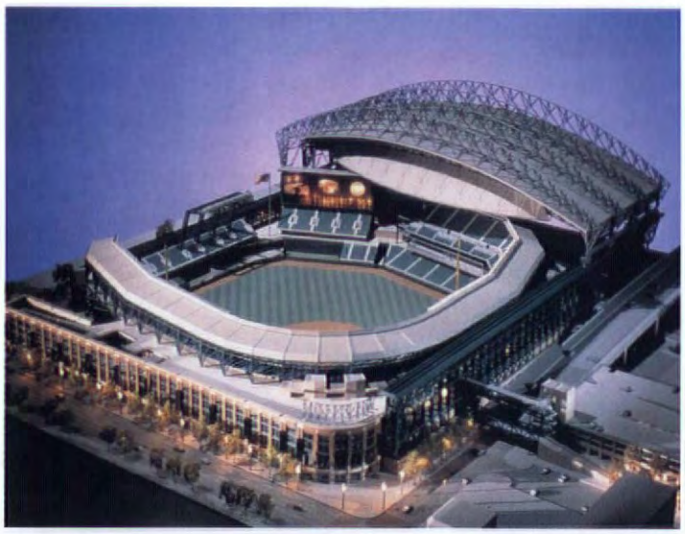
Tractebel Engineering has organised itself into subsidiary companies which each specialise in individual services to particular market sectors or geographical regions. Each subsidiary is autonomous within the group yet can, at any moment and as the need arises, draw upon the group's experience in order to meet a client's specific requirements. In this way, each subsidiary is highly flexible, thanks to its specific autonomy, yet has a potential for high performance thanks to its membership of the group.

Company profile
Tractebel Development's Building Development Division puts its experience to work in ensuring each of its clients' projects is completed following the best balance of quality, timing and cost.

Tractebel Development's strength lies in its ability to serve its clients through the wide-ranging experience of the staff of the whole Tractebel Engineering group as required.

Tractebel Development uses up-to-date computer equipment: PC's, workstations and mainframes (VAX, IBM) as well as the most advanced software – CAE, CAD, DAC. Its workstations are interconnected by a network enabled by Tractebel know-how, installed in a building of the latest generation, designed by Tractebel Development: an intelligent office. The company's in-house teams solve technical problems of all kinds using scientific software, developed in-house or by others following international codes.

Skilling Ward Magnusson Barkshire Inc



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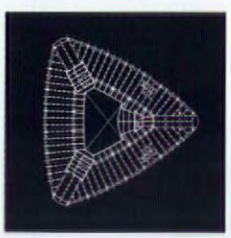

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1: New Pacific Northwest Baseball Park, Seattle, Washington, US

2: Pacific Plaza Towers, Manila, Philippines

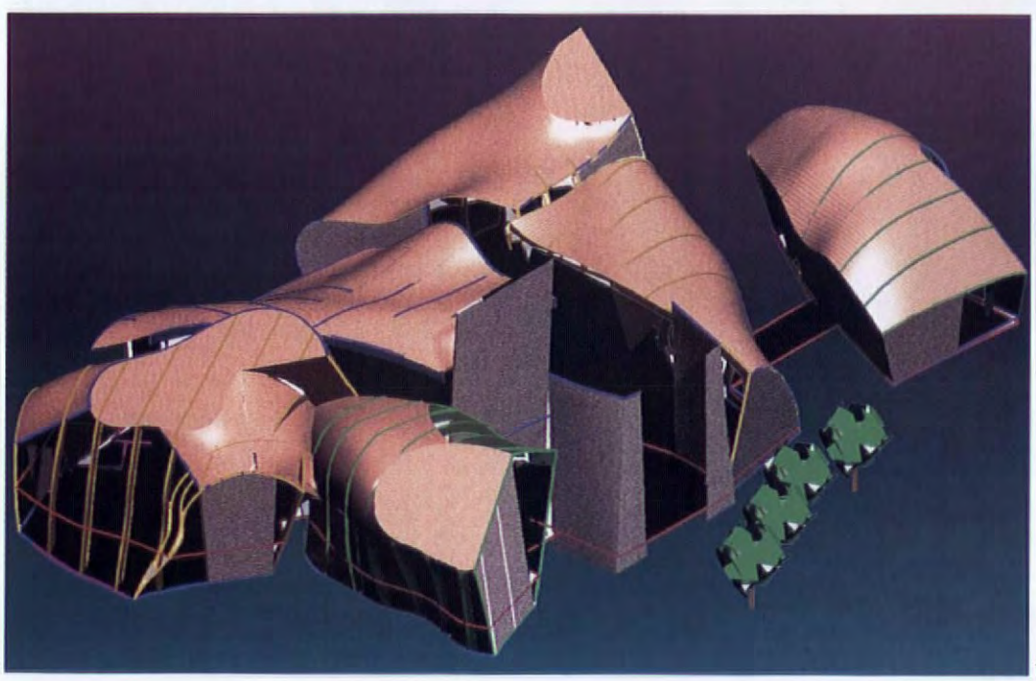
3: Microsoft Redmond West, Redmond, Washington, US

4: Securities Exchange Headquarters, Kuala Lumpur, Malaysia

5: World Trade Center, New York, New York, US

6: Experience Music Project, Seattle, Washington, US

7: World Finance Tower, Shanghai, China



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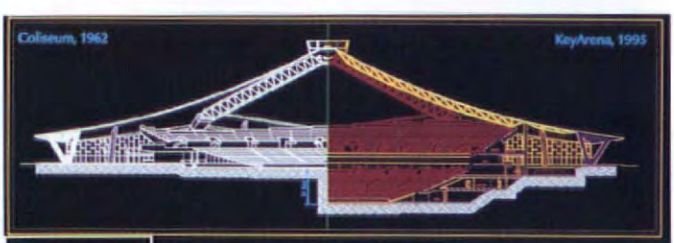

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8: Two Union Square, Seattle, Washington, USA

9: Key Arena, Seattle, Washington, USA

10: American Consulting Engineers Council Grand Conceptor Award for Key Arena

11: Hawaii Convention Centre, Honolulu, Hawaii, USA

11

SKILLING
WARD
MAGNUSSON
BARKSHIRE

Consulting Structural and Civil Engineers

1301 Fifth Avenue, Suite 3200, Seattle, WA 98101-2699, US
Tel: +1 206/292-1200. Fax: +1 206/292-1201
http://www.skilling.com email:jdm@skilling.com

Key personnel

John B Skilling, *Chairman*
Jon D Magnusson, P E, *CEO*
Arthur J Barkshire, P E, *President*
Ad A Gouwerok, P E, *Principal*
Jack L Guise, P E, *Principal*
Ron Klemencic, P E, *Principal*
Dr Tony Tschanz, P E, *Principal*

Size of firm

Personnel: 110

Recent projects

- Ireka Westin Hotel, Malaysia
- Samsung Global Gateway, Korea
- RCBC Plaza, Philippines
- New Shanghai International Plaza, China
- Saudia Maintenance Facility, Saudi Arabia
- Boeing Commercial Aircraft Group World Headquarters Office Building, US

Examples of "world's firsts"

- First super-high-strength cast-in-place concrete (20,000 psi)
- First hyper-efficient viscoelastic dampers
- First high-rise utilising braced core of large-diameter concrete-filled pipes to resist wind/earthquake forces
- First exterior space frame building
- First catenary-supported clear-span building

Practice profile

For the last 74 years, Skilling Ward Magnusson Barkshire Inc (SWMB) has provided state-of-the-art structural and civil consulting engineering services for projects located in over 25 countries. Satisfied clients mean repeat business, and our firm has grown 48 percent in the last year. This growth is directly attributable to the quality of our staff – carefully selected individuals representing the top 10 percent of their field in skills, experience, and schooling. Our engineers are often asked to present at national and international seminars and participate as members of committees organised to establish industry codes and standards. The first-hand experience we've had with codes, practices, languages, and customs throughout the US and the world means more effective participation on projects – large or small.

Frequently called upon to solve challenges that have stymied other firms, we thrive on providing engineering solutions that are focused, value-based, and safe – yet exciting. Our work – comprising many of the most recognisable buildings in the world – has received more than 90 awards for engineering excellence, including many "world's first" and industry benchmark accomplishments. SWMB has been recognised with more awards from the American Consulting Engineers Council in the last 10 years than any other structural engineering firm in the US, including, in 1996, the Grand Conceptor Award, their highest honour.

Expertise/specialisation

Office buildings
Convention facilities
Retail
Aviation
Stadiums/arenas
Hotels
Industrial
Health care
Parking structures
Transportation
Education
Lab/Hi-tech
Towers
Building preservation
Site infrastructure
Seismic engineering
Wind engineering

1

Montage: Hayes Davidson

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©C Gascoigne

4

Waterman Partnership

Consulting Engineers

Head office
46-47 Blackfriars Road
London SE1 8PN
UK
Tel: +44 171 928 7888
Fax: +44 171 928 3033

Other offices
Birmingham: +44 121 454 5858
Glasgow: +44 141 429 3386
Manchester: +44 161 839 8392
Bristol: +44 117 922 6710
Leeds: +44 113 256 3322
Southampton: +44 196 276 4055
Moscow: +7 095 261 1987

Associated offices
Athens, Chemnitz, Dublin, Frankfurt, Hamburg, Kampala, Lebanon, Nicosia, Porto, Paris, Prague, Stockholm, Sierra Leone, Toronto, Warsaw

Key personnel
Robert H Campbell

Practice profile

Waterman Partnership Holdings plc is an international company providing a full and complementary range of consulting engineering services to clients through the activities of it's subsidiary companies.

These trading companies provide professional advice and design services in civil, structural, mechanical, electrical and power engineering together with all aspects of environmental engineering and project safety management.

The practice was founded in 1952 and currently employs in excess of 500 staff, the majority of whom are Chartered Engineers, Qualified Scientists and Technicians.

Watermans has a wide range of clients throughout the public and private sectors within the UK and overseas.

Major projects

- London Bridge City Phase II and III – 100,000 square metres of commercial offices for St. Martins Property Corporation
- Banque Paribas, London – 43,000 square metres Bank Headquarters
- White City Retail, London – 100,000 square metres of retail and underground railway depot for Chelsfield
- Bluewater, Dartford Kent – 160,000 square metres of retail and leisure scheme for Lend Lease Global Investments Ltd
- Bull Ring, Birmingham – 100,000 square metres city centre retail scheme for Hammerson
- Aquarium – Beijing – 20,000 square metres seawater aquarium for Marinescape Ltd
- 11-12 Holborn Viaduct, London – a 13,000 square metres office development for Heron Properties Ltd
- Four Winds Plaza, Moscow – 45,000 square metres of commercial offices and retail space for Westec
- 99 Gresham Street, London – 12,000 square metres office development for Greycoat plc
- Thames Court, London – 25,000 square metres of offices for Markborough Property
- County Hall, London – over 100,000 square metres refurbishment of an historic building incorporating two hotels, restaurants, leisure facilities and an aquarium
- Medical Science Centre, Kuwait – 50,000 square metres medical facility for University of Kuwait

1: 4 Coleman Street, London
Architect: T P Bennett Partnership

2: 2-12 Gresham Street, London
Architect: Foster & Partners

3: Bluewater, Dartford, Kent
Architect: Benoy/Eric Kuhne

4: Europier, Heathrow Airport, London
Architect: Richard Rogers Partnership

In next month's WORLDARCHITECTURE

1: The Esplanade cultural complex by Michael Wilford and Partners and DP Architects

2: The Jerde Partnership's massive scheme for Canal City Hakata, Fukuoka, Japan

3: Rajeev Kathpalia's Indian National Trust for Art and Cultural Heritage, New Delhi

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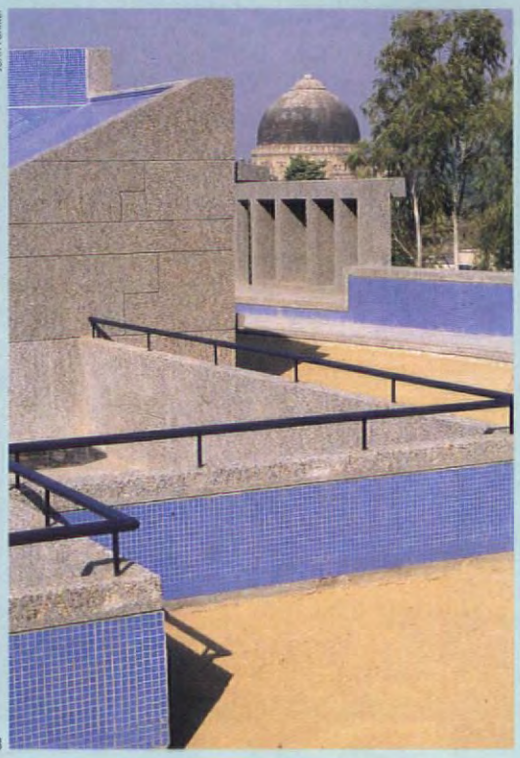
John Paniker



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BUSINESS

International news, reviews and previews.
OnScreen continues in the pursuit of computer related innovations and their relevance to architectural offices around the world.

COUNTRY FOCUS – INDIA

World Architecture provides a detailed report on construction and design in India. While the majority of Indian architects are working on commercial and residential interiors, some are producing new-build architecture worthy of international attention. A comprehensive introduction to the complex and volatile economic and political climate in India exposes the shortcomings of the Indian construction industry, and the openings for overseas architects. Plus an interview with Dhiru Thadani, of Bombay architects Thadani and Hetzel, who has benefited from combining his Indian origin with an American education. Building reviews include of one of Bombay's newest and biggest housing schemes by Raj Rewal; Jasbir Sawhney & Associates HUDCO Place mixed-use project and Rajeev Kathpalia's Indian National Trust for Art and Cultural Heritage both in New Delhi; and Bimal Patel's Gujarat High Court Complex in Ahmedabad.

PROFILE – DP ARCHITECTS

Singapore's DP Architects have made a commercial success of an underlying social mission. Having evolved organically into one of the island state's largest and busiest practices, DP continue to strive to make places which respect and promote the communal lifestyle and heterogeneous culture of Singapore's population. WA's profile examines how, as a substantial and necessarily hierarchical organisation, DP continue to foster new talent in their ranks; and how their collaboration with foreign practices has produced some buildings of global repute. As new work in China, India and Indonesia expands DP's international horizons, WA's timely profile considers how the experience of participating in the rapid development of their native country over previous decades can now equip the firm to tackle the daunting challenges associated with these emerging markets.

SPECIAL REPORT – URBAN REGENERATION

Joshua Levine in Asia, Ken Worpole in Europe and Charles Lockwood in the US report on the different approaches to urban regeneration around the globe. From India WA includes an interview with Rahul Mehrotra, author of many books on the possible approaches to regeneration in Bombay. Case studies of specific regions include Joshua Levine's comparison of Hanoi and Saigon in Vietnam. Charles Lockwood analyses the impact of the San Francisco waterfront developments on the regeneration of dockland areas in North American cities; Ken Worpole focuses on Amsterdam and finally, Jon Jerde's entertainment- led new town Canal City, Hakata in Fukuoka, Japan, demonstrates how commercial redevelopment can be combined with regenerative plans to create another city centre.

PRODUCTS –BUILDING ELEMENTS

Focusing on hi-tech solutions to building skins; including international innovations in cladding, roofing and glazing systems.


MERIDIANA
IP40
230
Ø125
205
Ø125
302
Ø 199
DESIGNER: FABIO REGGIANI
REGGIANI
97 NEW luminaires for '97
OTTOLOO
IP55
DESIGNER: FABIO REGGIANI
REGGIANI SPA ILLUMINAZIONE
VIA DELLA MISERICORDIA 33
20057 VEDANO AL LAMBRO MI ITALY
FAX 039 492714
REGGIANI LTD. LIGHTING
12 CHESTER ROAD
BOREHAMWOOD HERTS
WD6 1LT LONDON UK
FAX 0181 2073923
REGGIANI GmbH
LICHT-UND BELEUCHTUNGSTECHNIK
GRIESFELDSTRASSE 7
A-2351 WIENER NEUDORF
FAX 02236 64576-10
INTERNET:
http://info.co.uk/reggiani/

Laminated safety glass is reaching new heights. This advanced window technology was chosen for the world's tallest buildings—the spectacular new 451.9 m, 88-storey Petronas Twin Towers in Kuala Lumpur, Malaysia.

A tall order, indeed.

Laminated safety glass with DuPont Butacite® Polyvinyl Butyral Interlayer was selected because it offers clear advantages over tempered or wired glass—superior safety and security for occupants and pedestrians because even if broken, it keeps glass fragments in place, a cleaner, sharper reflection for aesthetics, plus outstanding UV protection for interior furnishings. Laminated glass also greatly reduces sound transmission.

To find out how DuPont can take your building project to the next level of safety and security, contact us at the address below. And ask about our entire family of laminated glass technologies—Butacite,® SentryGlas® and Spallshield.® Each is in a glass by itself.

And this complete offering is available only from DuPont.

Du Pont de Nemours Intl. S.A.,
2, Ch. du Pavillon,
CH-1218 Le Grand Saconnex,
Geneva, Switzerland
Fax: ++41-22-717 51 83

DUPONT®

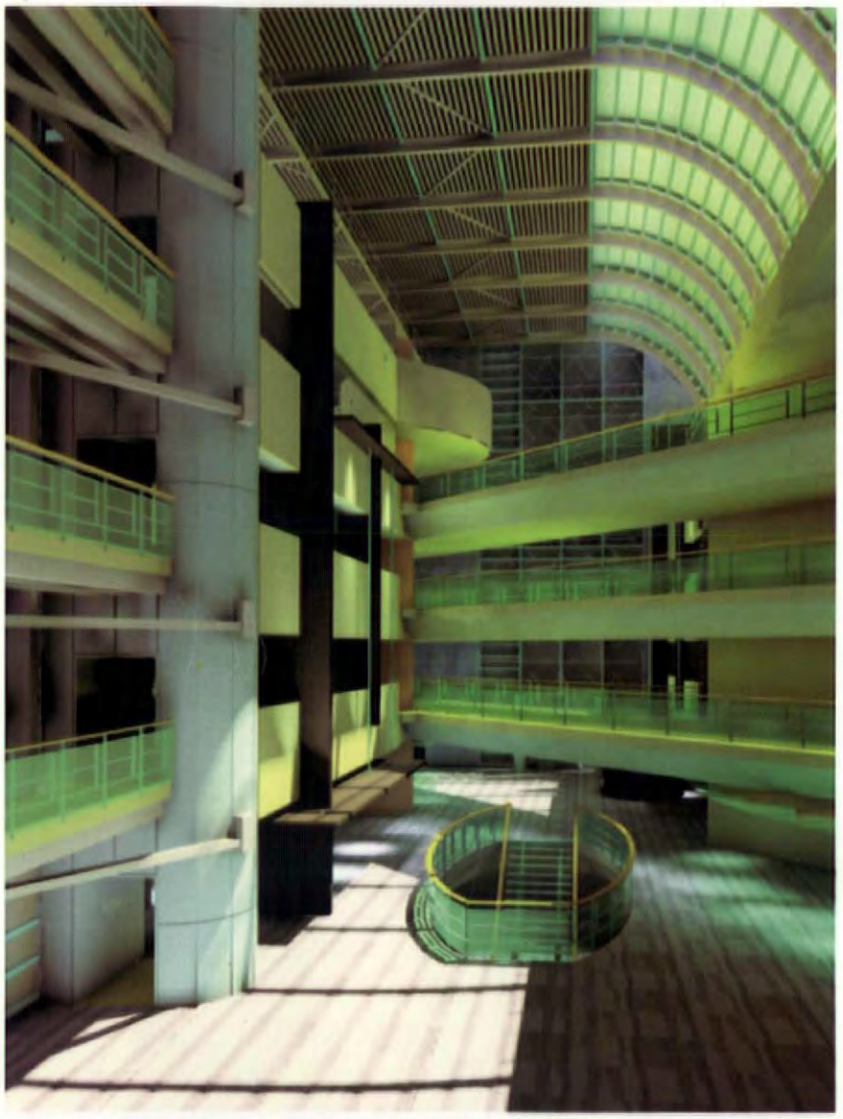
Butacite®

Polyvinyl Butyral Interlayer

ARRIS

voted

BEST ARCHITECTURAL CAD



ARRIS computer image by A. J. Diamond, Donald Schmitt and Co., Architects and Planners
Modeled and rendered by Dalibor Cizek

In November, 1996, a unique competition was held in Boston to determine the **Best Architectural CAD** software.
The results?
Over 300 architects and design professionals voted ARRIS, by Sigma Design International, the "**Overall Winner**" in a head-to-head contest with AutoArchitect using AutoCAD, Microstation TriForma by Bentley, ALLPLAN by Nemetschek, ArchiCAD, MiniCAD, DataCAD, and Architrion.

ARRIS voted:

- ***Best Overall Architectural CAD***
- ***Best Conceptual Sketching***
- ***Best Design***
- ***Best Presentation***
- ***Easiest at 3D Modeling***
- ***Most Accurate 3D Modeling***
- ***Best Quick-Shaded Perspectives***
- ***Best Animation***
- ***Best Rendering***
- ***Best Network Collaboration***

WINNER 1996 ARCHITECTURAL CAD CUP

"We congratulate the ARRIS Team and also Sigma Design, the developers of ARRIS. They clearly demonstrated that they are the current standard bearers of architectural CADD excellence."
Geoffrey Langdon
CAD Shoot-out Organizer

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