



Buildings Update

Editorial

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In brief

The environmental impact of building developments is under increasing world-wide scrutiny, as society recognizes the global connection between human activity, development and our environment. Issues surrounding climate change, ozone depletion, air quality and water use are being addressed on the global stage, and international protocols and agreements are being implemented to reduce our impact on our natural environment.

Globally, buildings consume 40% of the world's raw resources, 15% of fresh water, 50% of timber and up to 40% of global energy. 40% of solid land-fill waste, 40% of harmful air emissions and 35% of the world's CO² emissions are produced by buildings.

Environmentally Sustainable Design (ESD) seeks to address these issues, and promote development which minimises our impact on the environment in the building, operation and decommissioning processes.

Responding to this challenge, as a supporter of the New Zealand Green Building Council, Beca are leading change in the development of an industry recognised environmental building rating tool for commercial office developments. The office tool is being developed to assess the environmental impact of developments,



Brendon Dwyer – Editor

and act as a mechanism to monitor and track design decisions, to the extent possible, minimising the environmental impact of buildings.

Our award winning buildings (some of which are featured in this issue) are testament to our desire and ability to deliver holistic sound engineering solutions. Solutions that aim to be sympathetic to the environment, harness natural resources to, wherever possible, minimise the environmental impact and maximise overall building performance.



The new Statistics New Zealand building (see feature inside)

A top show

'Nature's Wisdom' was the theme for the Aichi World Expo 2005 in Japan; exploring ways in which technology – and the wisdom of the past – could be harnessed to allow humanity to live in harmony with the natural world.

Beca was part of a diverse team of architects, artists, engineers and filmmakers led by exhibition designers Story! Inc, to design a pavilion to showcase New Zealand's natural beauty, as well as convey sustainable development and the conservation of nature, to visitors.

Constructed entirely on site in Japan, the exhibition structure was constructed within the confines of a 18m x 18m x 9m high shell building provided by the Exhibition Authority. It was a tribute to the design team just how much usable area was packed into this shell. The pavilion incorporated exhibition spaces, a VIP entertainment area, green room, maintenance area, office, kitchen, plant and ablution facilities. Sustainable building materials, low emission paints, recycled carpet and low flow plumbing fixtures were specified by the Architect, Warren and Mahoney.

As the pavilion services consultant, Beca was faced with a range of infrastructure challenges. An 'energy recovery wheel' was installed to recover heating energy from the air stream and presentation lighting, allowing efficiency and less reliance on the Exhibition Authority's limited capacity infrastructure systems.

A low velocity displacement ventilation system was also integrated within the architectural walls of the exhibition space, minimising spatial demand and allowing the air entering the exhibition space to be introduced at a higher

temperature than a traditional high level air conditioning system, reducing the load on the infrastructure.

The New Zealand pavilion was an overwhelming success. Visited by four million people, the Expo organisers chose it as one of the top three in the 'single pavilion' award category, and one of the top 12 overall out of 130 pavilions.

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The New Zealand pavilion at the 2005 Aichi World Trade Expo

Building Services

Expo pavilion showcases sustainable technology and design.

Singapore goes from green to platinum

Beca Environmentally Sustainable Design (ESD) work in Singapore was further recognised in April this year when the **Republic Polytechnic** was awarded a Platinum Rating under the Singapore Government's Building Control Authority (BCA) Green Mark Awards. This follows Beca's involvement in the National Library Building, one of the inaugural projects granted Platinum status since the BCA introduced the Green Mark Ratings in 2005.

Republic Polytechnic is a 200,000m² campus, which opened to students in phases over 2006. From the outset Beca, in collaboration with DP Architects (Singapore) and Maki Associates (Japan), set low energy and sustainable targets for the competition stage design. Sustainable features were heavily influenced by an integrated design approach using the building form, external shading systems and landscaping to minimise energy requirements for lighting and cooling. A central energy centre provides campus-wide power and chilled water distribution, and is the first campus in Singapore to implement Thermal Energy Storage to optimise the chiller operation. Other features include rain water harvesting, chemical free condenser water treatment systems, solar energy from Photo Voltaic (PV) cells for lighting, mixed

mode ventilation systems for the sports halls and use of recycled materials.

Singapore's new **National Library Building** (a \$200 million project) was delivered as a design and build project. The building's architectural form was well established in the client's concept design and sustainable brief. Beca led a multidiscipline team of designers, coordinating modelling for day lighting, energy and comfort. Optimising the daylight potential of the shaded façade, combined with the control systems applied to its air conditioning and ventilation systems, heavily influences the building's energy consumption. A ground level events plaza is naturally ventilated using the building as a thermal stack to assist air movement. The library also incorporates a 600-seat drama centre which uses displacement ventilation.

To date the BCA has recognised only four Singapore buildings as Green Mark Platinum.

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Environmentally Sustainable Design

Award winning design from Beca's Singapore office.



The National Library Building (Singapore)

Ian Stephenson



Ian is a chartered professional engineer with 17 years of design experience. He has been a key team member on a number of projects and is a strong advocate for low energy design. Recent projects he has been involved with include: George

Street Retail Development, Christchurch Women's Hospital, Paraparaumu Library, South Christchurch Library, and Stadium Southland.

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Craig Price



Craig leads Beca's South Island Regional Office in Christchurch, and is the Director for the ESD Group. Craig has been involved in many of Beca's award winning projects, including South Christchurch Library, Waitakere Trusts Stadium, and Paraparaumu Library. He was

recently nominated to the board of the New Zealand Green Building Council.

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Scott Munro



Scott, a Senior Associate Director, has 15 years design experience since joining Beca in 1991, and developed his interest in sustainable design while working on UK projects such as The Earth Centre. Scott coordinates Beca's ESD inputs

for projects in the Asia region. Recent Singapore highlights include the National Library Building and the Singapore Management University.

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Alan Barbour



Alan, a Senior Mechanical Engineer, leads Beca Buildings ESD group. He has over 16 years building design experience in New Zealand and overseas. He is a Greenstar Accredited Professional, and recent projects he's been involved with include: Site 7 Kumutoto,

Wellington Waterfront, Statistics New Zealand Building, Harbour Quays Business Park, Papamoa Library and Community Centre and the New Zealand Pavilion for the Aichi World Expo in Japan.

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Brendon Dwyer



Brendon is the Auckland champion for the Beca Buildings ESD group and has over 11 years building design experience in New Zealand and overseas. Recent projects he's been involved with include Auckland Airports' Domestic Terminal refurbishment, Pacific

Place 410,000m² mixed use development in Jakarta, Strathallan Arts & Technology School, BNZ Auckland and Wellington fitout projects and various other commercial office developments providing both services and ESD advice. Brendon is a BREEAM Accredited Professional.

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Time saving design

Innovative thinking saves time in a cold storage expansion project.

Swire Cold Storage Pty Ltd is increasing their presence in the Australian cold storage market by expanding their existing facilities in Lurnea, New South Wales. The addition of a new 5,250m² freezer capable of housing 11,000 pallets at -28°C represents a significant increase in their local storage capacity and represents the first of four stages of expansion at the facility.

Design and documentation began in earnest in late September 2005, geared towards achieving a building handover in July 2006 to enable Swire Cold Storage to secure new contracts starting in August 2006. The project was tendered as a series of trade packages with the client adopting the role of Principal and Beca in the role of Superintendent. To assist in speeding up the construction process, Beca designed a modified form of

freezer floor for this project. The innovative 'economical floor' uses a cement treated crushed rock layer over the sub grade vent pipes in lieu of the traditional reinforced concrete slab. The design has saved both time and money, and due to it's success on this project, has been adopted as the default design for freezer floors for Swire Cold Storage.

Construction on the site, under the watchful eyes of Tom O'Sullivan, Ross Darbyshire and Andrew Burton, was completed in July 2006.

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A classy establishment

With its striking façade, AUT's new business school in downtown Auckland was designed to create a strong visual impact, and to reflect the school's modern spirit and proximity to the central business district.

The bold architectural design and site constraints presented significant engineering challenges to Beca's structural engineers. The site has a sloping topography, with existing buildings adjacent to the southeast boundary founded on shallow footings, necessitating innovative ground retention systems. As a modern educational facility, the structural system needed to cater for future flexibility and allow for reconfiguration of internal spaces without requiring structural changes.

Eccentrically Braced Frames (EBF's) around the building perimeter hold the building laterally under earthquake and wind effects. The columns are in-filled with fibre reinforced concrete to achieve the required fire rating.

Honed concrete floors in the public circulation areas constitute one of the finest examples of the use of honed concrete flooring in New Zealand.

The building façade, with its mass of glass fibre reinforced concrete (GRC) panels, functions as both an engineering solution and an architectural feature. Usually only single-skinned, the AUT building has double-skinned GRC panels so that the inner steel framework is not visible when viewed from within. These panels reduce solar gain, particularly on the western building face, without impinging upon the amount of natural light within the building, or the views to the north.

Close collaboration between architect, project managers, contractors and Beca was integral to the successful

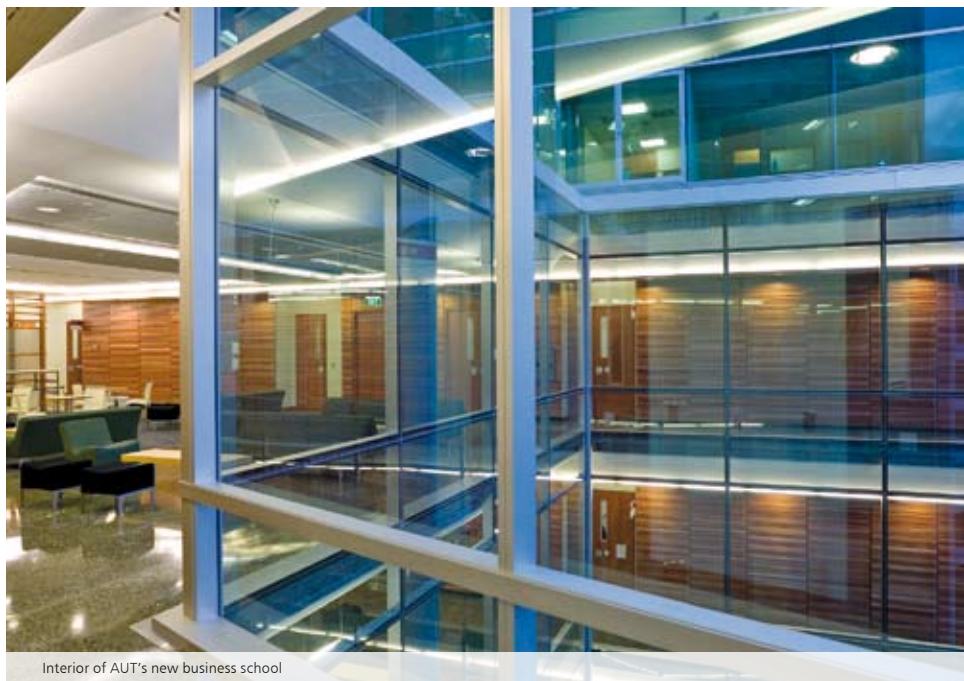
delivery of this outstanding educational establishment in the heart the city.

The building was a recent winner (Education and Arts Award) in the prestigious Property Council of New Zealand Rider Hunt Property Awards.

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Interior of AUT's new business school

Structural

Strong collaborative working relationships between stakeholders at the heart of a successful project delivery.

Reconfiguring the base

Pacific Place Jakarta (PPJ) is a substantial development undergoing a massive facelift. Intended to form the centrepiece of Jakarta's Sudirman CBD district, construction on the PPJ project stalled at the height of the Asian financial crisis in 1997. The project has recently been rejuvenated and Beca are working with the property developer PT Pacific Place Jakarta in the development of a significantly different and larger building complex on the same site.

Key features of the new US\$250 million, 410,000 m² PPJ include two 35-storey luxury apartment towers (with apartment sizes of 480m² and 960m²), a 37-storey mixed-use tower (offices, hotel and serviced apartments), a 60-room boutique hotel, an eight level retail mall and an entertainment podium and five levels of basement.

Beca are providing mechanical and electrical and structural engineering services to the project. With significant retrofit works to accommodate the proposed new building configuration, the structural engineering has presented some critical challenges. Beca Manager – Auckland Commercial Structures Neil Horsfield elaborates:

"Prior to the original development stopping in 1997 a substantial portion of the basement and part of the high rise construction was complete. The proposed

development requires eight levels of podium to be added (previously there were two) and two apartment towers to be re-orientated through 90 degrees and re-planned as residential accommodation. The existing substructure needs to be retrofitted to be compatible with the proposed new layouts, including strengthening to existing and constructing new foundations, and modifying existing framing. There is considerable complexity in designing tower buildings to rise out of a retail podium. To facilitate the design we needed to completely rethink the seismic design philosophy for the buildings."

Beca's depth of experience and resources enabled rapid development of solutions to allow demolition and foundation retrofit works to proceed before the design of the buildings had been finalised. A multidisciplinary approach, and the ability to work collaboratively and seamlessly across offices in three different countries (New Zealand, Singapore and Indonesia), and with the design architect in the US, has, during various stages of the design allowed a 24 hour operation.

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Civil and Structural

Engineering challenges aplenty in a landmark development in the heart of Jakarta's CBD.



Pulling out all the stops

Beca led coordinated approach delivers a quality building in a tight timeframe.

Air New Zealand's recent purchase of a fleet of new Boeing 777-200ER aircraft generated a pressing need for a facility to train pilots in the operation of the new aircraft type. With no local options available, and leasing training facilities offshore costly, Air New Zealand decided to purchase a B777 flight simulator to undertake the training in New Zealand. A facility was required to house it, and it had to be operational as quickly as possible.

Beca, providing the project management, engineering and architectural services on the project, were able to achieve an aggressive programme that delivered the facility in four months, permitting pilot training to commence in October 2005.

A strong working relationship with Air New Zealand regarding procurement decisions, in-house collaboration with the contractor, complemented by a single point multidisciplinary service provided the measure of control needed to drive the extremely tight design and construction programme.

The facility houses flight simulators for the Boeing 777 and Dash 8 aircraft, and the purpose built flight-training centre is the first of its kind in New Zealand. Built initially to accommodate these modern simulators, it has been designed for the future, with provision for a total of eight simulator halls and associated training and engineering facilities. The modular design allows for expansion without disruption to operations, as well as supporting the different requirements of other manufacturers' simulators.

Prior to the creation of the purpose-built flight training centre, Beca provided project management and design services for the Airbus A320 and B737-300 simulators housed in Air New Zealand's jet base.

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Simulator hall in Air New Zealand's new training facility

Building a better work space

An ESD approach for Statistics New Zealand aims to enhance the quality of the working environment.

The Statistics New Zealand building is a distinctive new Wellington landmark in the Harbour Quays business park. Statistics New Zealand wanted a quality working environment for employees, making use of modern open planning, views and natural light. The building was designed from the inside out, the key focus areas being the working environment, comfort, energy efficiency and flexibility.

Beca was appointed as building services consultants, and used integrated ESD and energy efficient design approaches to achieve the project goals. 3D computer simulation modelling of energy use indicated a low-pressure variable air volume air conditioning system as the preferred option. This took advantage of the Wellington climate to use 'free cooling' with enhanced ventilation performance and reduced energy consumption for much of the year.

'Swirl' supply air diffusers were specified in the office areas, enhancing air distribution uniformity, while providing improved comfort over conventional diffusers. Variable speed controls were provided on all main systems with demand control of heating and cooling systems.

Dimmable ballasts are provided on office lighting, with a daylight control system to reduce the artificial lighting

levels, and to minimise energy use when natural lighting is available.

The services were designed on a modular arrangement to assist future flexibility for tenant changes. At the heart lies a fully distributed Building Management System (BMS), which monitors and controls the building services to balance comfort criteria and energy efficiency. The BMS system also meters main energy uses.

While the project brief had no requirement to achieve GreenStar rating, an independent design review carried out prior to completion benchmarked the building design to be equivalent to a 4 star GreenStar rating. This rating indicates Best Practice in energy efficiency and environmental performance, and the building featured as a case study project in the recent Ministry for the Environment 'Value Case for Sustainable Buildings' report.

The building was a recent winner (Commercial Office Property Award) at the prestigious Property Council of New Zealand Rider Hunt Property Awards.

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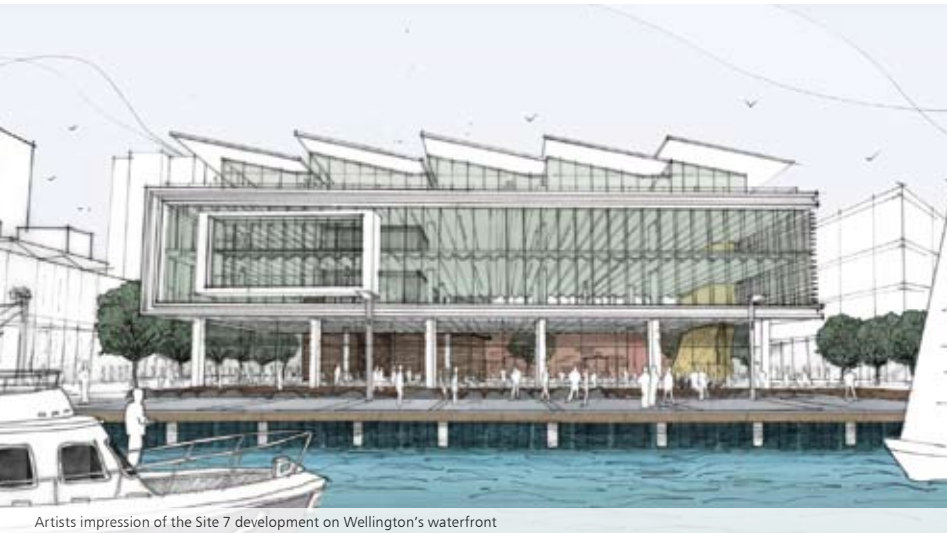
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A new office building on Wellington's waterfront gets the ESD treatment.

The construction of New Zealand's first new office building designed using Environmentally Sustainable Design (ESD) is well underway on Wellington's waterfront. Working closely with Studio Pacific Architects and the developer Dominion Funds, Beca designed the engineering services for this landmark project using an ESD approach. Their ambitious targets include using 60% less energy and 70% less water than comparable buildings, and they aim to set a new benchmark in environmental performance.

The architectural concept was focused on transparency, with extensively glazed façades to maximise views, both seaward, and into a sheltered plaza. The highly transparent envelope presented many challenges in developing the services to achieve a comfortable office environment, while achieving the required performance targets.



Artists impression of the Site 7 development on Wellington's waterfront

Extensive use of 3D computer simulation analysis was carried out by Beca to inform and target the design, which makes extensive use of natural light and natural ventilation to optimise energy use and comfort conditions. A 'mixed mode' air conditioning strategy was adopted, with windows for natural ventilation controlled by the intelligent Building Management System (BMS). The chilled beam air conditioning system was assessed as the appropriate system for the project, using Beca experience from the South Christchurch Library project, currently the only building in New Zealand where chilled beams are operating.

Solar gains are controlled by active shading systems, which use external louvres and interstitial blinds within glazed facades. Blinds and louvres are controlled by photo sensor controls to optimise performance. Rainwater recycling, solar water heating, intelligent and addressable lighting controls, heat recovery systems and environmentally preferable materials all helped to improve the overall environmental performance of the project, and to target a five-star equivalent GreenStar rating.

Innovation is demonstrated in a number of aspects. In particular, through the application of active façade technology and the interaction with the building services systems. This allows the building to be operated using either natural lighting and ventilation, or energy efficient artificial systems. Such extensive use of ESD features in an office building is aiming to set new standards for New Zealand buildings.

Beca also designed the fit-out services for the tenant, Meridian Energy, extending the base building principles to encompass the tenant requirements.

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Solidifying shaky ground

Beca expertise can assess how your building might be affected by the 2004 Building Act.

Changes to the New Zealand Building Act in 2004 have expanded the requirements relating to earthquake prone buildings in New Zealand.

Prior to the changes in 2004 the emphasis was solely on unreinforced masonry and concrete buildings, and in particular, only those that did not meet what is today considered a very low standard compared with modern buildings.

Observation of the aftermath of earthquakes overseas over the last twenty years have indicated that a significant risk to occupants may also result from the potential poor performance of more modern buildings built prior to the mid-1970s. The mid-1970s is considered to be when modern earthquake design philosophies were first incorporated in the New Zealand earthquake code.

The latest Building Act updates the definition of an earthquake prone building and also requires all Councils to develop a policy regarding how they intend to identify, prioritise and deal with earthquake prone buildings within their jurisdictions. The Act requires that these policies be in place by the end of June 2006.

Beca Technical Director and Manager – Wellington Structural, Rob Jury, is leading a study group of the New Zealand Society for Earthquake Engineering. The group has been working, with the support of the Department of Building and Housing, to prepare a document outlining guidelines for engineers on how to assess existing buildings against the requirement of the Act. This document was published at the end of June 2006.

Beca structural and earthquake engineers are well acquainted with the requirements of the Act and the latest technology available to assess the earthquake performance of existing buildings. Using these techniques, we are able to provide realistic assessments of expected performance, avoid unnecessary conservatism and develop efficient and "sympathetic" retrofit schemes.

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Lighting up Parliament

A dated lighting system in the Beehive's banqueting hall has recently been given a well-needed reworking with Beca's illumination specialists at the heart of the project. Designed in the 1970s, the banquet hall lighting had consisted of chandeliers and ceiling mounted downlights. With the chandeliers contributing more of a cosmetic feature, the down lights provided the main lighting. However, the overall effect was poor.

As the banquet hall is a multifunction area (dining, conferences and presentations), both lower and stronger levels of lighting were required. The physical dimensions of the hall presented some design challenges in finding a system that would work. Beca Senior Electrical Engineer Robert Hirschberg comments:

"The hall is a long, narrow, curved space with a ceiling height greater than its width. The outer curved wall is fully glazed with strong vertical marble columns. The ceiling has deep concrete radial beams in-filled with

timber slats. To accentuate the room features, and to accommodate the multi-function nature of the space, a large feature was designed in association with the architect. The purpose made fitting stands 1.5 metres tall and includes a 1 metre diameter illuminated glass disc. Ceiling mounted square downlights have asymmetrical reflectors allowing them to be mounted near the wall, so as not to detract from the appearance of the ceiling, and switching allows the lights to provide two levels of lights.

Up-down lights mounted on the marble column provide lighting to the outer part of the space and also accentuate the marble columns. High-level spotlights illuminate the vertical surface of the ceiling's concrete beams and provide a low level ambience for candlelit dinners."

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Illumination

Beca's illumination engineers brighten up a multifunction space.



Exploring new markets

Es salaam aleikom from Dubai (translated means Hello from Dubai). Beca has had a presence in the Middle East since 2003 when we undertook seismic retrofitting design for sensitive buildings in Turkey. With time, the number of projects has increased and the decision was made in late 2005 to open a branch office of Beca International Ltd in Dubai to best serve our Middle East based clients. The office is led by Ken Barrett, our Middle East Regional Manager, and is based in the Trade Centre business district in Dubai.

Current projects in Dubai involve mechanical and electrical (M&E), and civil and structural (C&S) services for

retail, commercial and hotel developments. Beca is also undertaking master planning and feasibility study work for a landmark project in Oman.

The Middle East is an exciting region to be given the level of property investment and rate of development occurring throughout the Gulf Corporation Council and its neighbours. Beca looks forward to a long presence and successful relationships with its clients in this market.

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International

Establishing a presence in the Middle East.

BCHF (UK) grows in Britain

Continuing on from a successful first year of operation, the London office, BCHF (UK) Ltd, has recently been appointed for a significant hotel project near Heathrow. The prestigious 880-bedroom Park Inn Hotel is replacing its services infrastructure. BCHF will design the works, and assist with project management over the next two years.

The appointment follows on from survey work the office carried out late last year for the client. Technical director, Mark Crawford, says it is not unusual for the team to win follow-up contracts like this from the same client.

"A lot of consultants tend to reduce their input significantly toward the end of projects as their fees run out. We try and differentiate ourselves by increasing our commitment at this critical stage. We also undertake post-contract visits at three, six and 12 months to make sure the performance of the building is right throughout all seasons."

Commissioning management is a particular strength of the office; an independent set of 'eyes and ears' to make sure a building is commissioned and installed correctly.

One of BCHF's key client's, UBS, appointed the London team to manage the commissioning and testing of a major upgrade to its largest UK data centre in 2005. The success of this project has helped lead the office into commissioning management roles with Imperial College, JP Morgan, and the Atomic Weapons Establishment.

BCHF has recently expanded to fill a second floor of offices adjacent to Liverpool Street station in the heart of the city. Continued growth is expected over the next twelve months says director, Greg Parker.

"Recruiting quality staff is not easy but we are finding that as we become better known, we are being approached by good engineers wanting to work with us," he says. "The team we have are enthusiastic and really enjoy the challenges of the job, and that makes others want to be part of it."

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Building Services

London office goes from strength to strength.



The BT Sevenoaks building (London) – BCHF (UK) were responsible for a £1 million fitout project

Earthquake engineering skills in demand the world over.



He was there...

When it comes to earthquake engineering expertise, Dr Richard Sharpe is a well-recognised name in international circles. And a look at his diary confirms that! Earthquake engineering is gaining popularity with many governments, and Richard has been busy spreading the gospel, especially of base-isolation technology. "Many international communities are realising that base-isolation of critical facilities is the only practical way of ensuring these survive major earthquakes," says Richard (Beca's Technical Director of earthquake engineering).

In recent months, Richard has been involved with a World Bank-funded project for the Turkey government. In a joint venture with Turkish consulting engineers Prota, Beca's Turkey office completed a feasibility study for strengthening apartment buildings in Bakırköy, İstanbul.

The study was part of an ongoing effort since the 1999 earthquake to the east of İstanbul, and a lead up to the NZ\$650 million İstanbul Seismic Risk Mitigation and Emergency Preparedness Project (ISMEP) that has started this year. The project will retrofit around 40 hospitals, 600 schools and several clinics and administrative

buildings. "It will also demolish and rebuild a building if found to be too weak to be retrofitted," Richard informs.

But it's not just a Turkey visa that has filled Richard's passport in the recent months. He has been delivering workshops and papers in the Middle East and San Francisco, discussed a proposed base-isolated building with the Iranian Building Research Council and met clients in Dubai and Singapore during his stopovers. Then, there was the seismic assessment of offices and ex-pat houses in Islamabad in Pakistan and a meeting with possible partners in Singapore for developing intelligent systems to distinguish between earthquakes and other vibrations on offshore platforms. "And did I mention the proposal to NZAID to assist Nepal's National Society of Earthquake Technology with their assessment of hospitals for seismic upgrade?" Richard adds as he walks out of the office for his next flight to Samoa to investigate a national disaster insurance scheme.

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In brief



On August 17 2005, Kiwi bungee jumping supremo AJ Hackett leapt to a Guinness-accredited world record SkyJump from the Macau Tower, Macau. Working closely with AJ Hackett and Jump Technics (designers and manufacturers of the proprietary jump equipment), Beca designed the jump platform and guide-wire system, drawing upon our detailed knowledge of the structure (designed by Beca in 1995-2000). The jump is now open to the public (pictured) and is 41 metres higher than the only other SkyJump in the world at Auckland's Sky Tower.



The Lumley Centre, Auckland's newest addition to its burgeoning skyline, opened to the public in July 2005. Beca designed and project managed the building services on this landmark project. The 29-level commercial complex features a highly modern fit out and an external façade that represents the city's passion for yachting.



New Zealand
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Papua New Guinea
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