INNOVATE NZ Awards of Excellence

AWARDS OF EXCELLENCE

INNOVATE

2015

ACENZ

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INNOVATE

A MESSAGE FROM THE PRESIDENT

"The quality of life we enjoy in New Zealand, is in no small part, due to our efforts in delivering and maintaining the necessary infrastructure for our communities. I urge you to continue to strive to deliver excellent and innovative projects in the wider public interest"

It never ceases to amaze me the positive influence that our members have on the communities that they live in through the projects and advice they deliver. The INNOVATE NZ and ACENZ Awards provide a superb opportunity to recognise and celebrate these achievements and contributions.

All recipients of INNOVATE Awards can be proud of that significant contribution, the recognition of innovation and excellence in their projects and, of going the extra mile for their clients. These outstanding projects are also delivered through effective team work and collaborative involvement of clients and contractors.

Our congratulations to all award recipients. We recognise our up and coming talent, and individual industry contributions with the ACENZ Awards. Congratulations to those winners also.

With ACENZ now representing consultants in the natural and built environment, it is important to acknowledge the diversity and wide range of professional contributions to these successful projects including engineering, planning, surveying, architectural and project management specialists. The INNOVATE Awards are valued for the quality of judging and rigorous approach taken by our judges. We thank them for the time they volunteer in assessing these outstanding projects.

Not only do we acknowledge this year's award winning projects, but also the collective contribution that our members' projects have made over the first 50 years of the ACENZ Awards. These demonstrate the contribution our industry has made in building the nation. The quality of life we enjoy in New Zealand, is in no small part, due to our efforts in delivering and maintaining the necessary infrastructure for our communities. I urge you to continue to strive to deliver excellent and innovative projects in the wider public interest.

Keryn Kliskey
President

MEMBERSHIP

ACENZ represents professionals in the built and natural environment and members make up around 95% of New Zealand's consulting engineering companies and almost all of the infrastructure design industry. ACENZ membership has steadily grown with over 175 member firms that now represent over 10,000 employees.

All member firms of ACENZ must be independent, and their principals are required to be people who are full members of a recognised professional body in order to ensure a consistently high standard of quality and service is maintained. All ACENZ members are subject to a code of conduct, and must have processes in place regarding quality management, must display focus upon ongoing development of business and technical education, and must hold professional indemnity insurance to a minimum level of $500,000.

Our members aspire to be trusted advisors to their clients and the public, providing solutions that involve innovation, excellence and quality. They pride themselves in being at the forefront of innovation and achieving robust outcomes in consulting works related to the built and natural environment. The INNOVATE NZ Awards of Excellence celebrates these achievements and recognises the contribution that outstanding projects make to the benefit of New Zealand infrastructure and the needs of society.

The ACENZ website, **www.acenz.org.nz** offers information on the activities of the association, documents available for engaging a consultant, a directory of members and the services they offer and more.

ABOUT ACENZ

The Association of Consulting and Engineering Professionals in New Zealand (ACENZ) represents business services and advocacy in the consulting industry for engineering and related professionals.

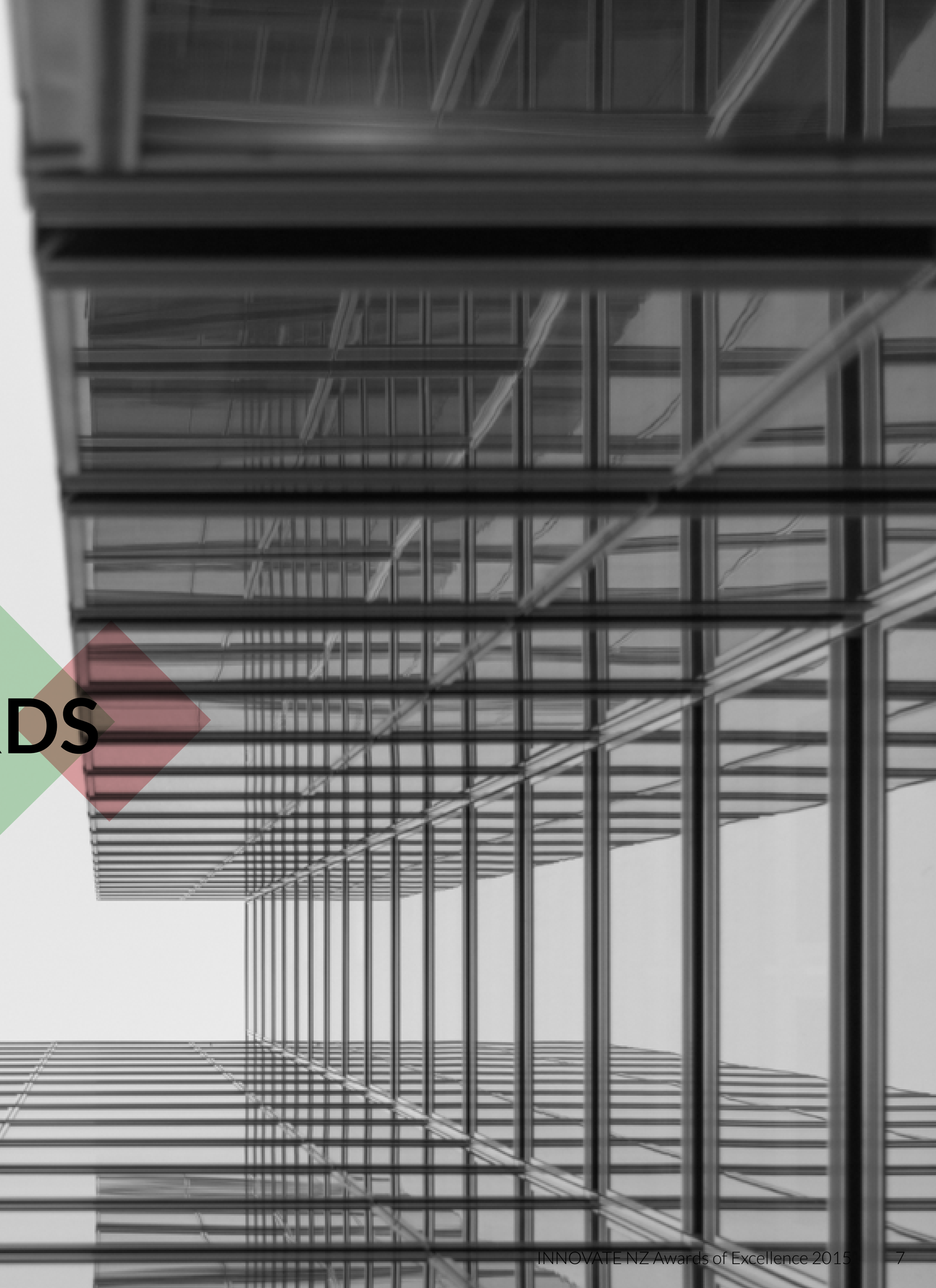
ACENZ continues to work with other professionals and the wider construction industry towards implementing reasonable conditions and robust practice in contracts & procurement and has achieved progress in developing relevant guidelines and documentation.

ACENZ is a member of the International Federation of Consulting Engineers (FIDIC) who represent the consulting engineering interests for over 80 countries. ACENZ is proud to contribute in tangible ways to FIDIC by sharing documentation and best practice guidelines with international colleagues, and providing representation for working parties and committees.

ACENZ AWARDS

Tonkin & Taylor Future Leader Award

AECOM Best Practical Work Report Award



TONKIN & TAYLOR ACENZ FUTURE LEADER AWARD 2015

WINNER

KATHRYN MCDONALD / OPUS INTERNATIONAL CONSULTANTS LTD

ABOUT THE AWARD

Introduced by the association in 1998, the award was established to give recognition and acknowledgement to the future leaders of our industry. ACENZ aims to empower young engineers and equip them with management tools and training through the experiences of this award.

PRIZE

The winner receives an opportunity of a lifetime, including registration and travel costs for the FIDIC Young Professionals Management Training Programme. This is run through webinars with young professionals from all over the world during the year with the final module to be completed at the 2016 FIDIC Annual Conference. The winner receives the prestigious title "Future Leader 2015" and framed certificate, $1,500 cash prize and a year on the ACENZ Board from November 2016 through July 2017.

Runner-up finalists will receive a framed certificate and $1,000 towards an approved business management course.

Kat is a Certified Environmental Practitioner with 10 years' experience in environmental management, environmental science and sustainability. Kat joined Opus in 2010 as an Environmental and Sustainability Consultant in the Westhaven office and specialises in environmetnal impact assessment, environmental monitoring, preparation of environmental management plans/systems and sustainability projects. A large part of Kat's role involves leading teams of contractors and consultants on multi-disciplinary projects to achieve better environmental and sustainability outcomes. Kat achieved her accreditation as an Environmental Practitioner in 2012 and is a member of the Environmental Institute of Australia and New Zealand (MEIANZ).

Kat's involvement in the environmental sector contributed to her strong desire to understand more about the wider context surrounding environmental issues. This led Kat to explore broader sustainability concepts and framewokrs in 2012 when she started her Masters in Life Cycle Assessment part time through Massey University. In 2013 she went on to graduate with a Certificate in Sustainable Business Practice from Otago Polytechnic. Kat's enthusiasm and passion for sustainability has seen her take on two distinct leadership roles within Opus. In 2013 she was appointed as Chair of the Sustainability Professional Interest Network, which is a role that oversees the technical wellbeing of over 200 professionals worldwide. In 2014 she was appointed as the Company Sustainability Leader, a global role with a strong strategic focus involving policy development, strategy and planning, and sustainability reporting. Kat loves the challenge and opportunities these roles provide, not only becuase they focus on improving the sustainablity performance at Opus but also because she believes consulting companies have incredible potential to influence design towards a better world.

Kat has remained committed to developing her leadership skills outside the organisation with participation in the Sustainable Business Council Future Leaders Program in 2013, the Sustainability Business Network Authentic Leadership Program in 2014 and also in her role as the Auckland Branch Coordinator for the Environmental Institute of Australia and New Zealand. She believes in sharing her knowledge through presentations both internally and externally at conferences and universities. She is passionate about collaborative design and embedding sustainability principles early in the decision making process to ensure our projects create lasting benefits for society.

FINALIST

BEN HENSON / BECA

Ben is a Senior Associate and manager of the Auckland Beca Building Services team. As a mechanical engineer and manager he has led a range of significant building and infrastructure projects. Strong leadership and a passion for engineering has seen Ben build strong teams around him to deliver complex projects for some of New Zealand's most discerning clients.

Ben completed his Honours Degree in Mechanical Engineering in 2004 from Canterbury University. Ben quickly progressed from a design engineer to leading a team of designers to deliver New Zealand's first fully compliant and ACENZ award winning PC3 Laboratory, through to managing the structural and building services teams on New Zealand's first significant public private partnership (PPP) project, the Wiri Men's Prison. He is one of Beca's youngest Section Managers, managing a team of 35. Ben balances his responsibilities as a Section Manager while continuing to lead and deliver iconic projects including some of Beca's largest projects.

Ben is a Professional Member of IPENZ, a New Zealand Chartered Professional Engineer (CPEng), Beca shareholder and graduate of the Beca Leadership Programme. Ben was named NZEE New Zealand Young Engineer of the Year 2013 and his projects have won the ACENZ Innovate Gold Award and the NZ Property Council Excellence Award.

"Ben is extremely adept at managing the commercial, technical and political drivers of the building owner, senior management and end users."

"Ben is a very able manager but his true strength lies in his leadership. People want to work for and with him."

FINALIST

BLAIR CURRIE / BCD GROUP LTD

Blair is a Director at BCD Group Limited which he founded in May 2010. Prior to this he was employed at Holmes Consulting Group Ltd as a Project Engineer, during which he became a Chartered Professional Engineer. Blair's responsibilities in his current role span the spectrum of the engineering and consulting profession, from technical design work in Civil and Structural fields, design and analysis, stakeholder relationship management, analytical work and documentation.

Blair has the ability to foresee potential issues prior to them causing setbacks and is able to deliver economic and constructible solutions.

In 2014, Blair was awarded the Property Council Young Achiever Award for his distinction and impact in the Waikato region.

"Blair's verbal and written communication with clients and contractors are highly praised, as with his multitasking and focus to ensure that his, BCD Group's and the clients expectations for the project are not only met but exceeded."

AECOM ACENZ BEST PRACTICAL WORK REPORT AWARD 2015

ABOUT THE AWARD

The student awards were introduced by ACENZ in 1996 for fourth year engineering students. AECOM is pleased to sponsor this award jointly with ACENZ since 2010. The award encourages the next generation of engineers to develop good written skills which is a valuable and important skill to have. The award is presented to the three top marked reports.

ENTRY CRITERIA

The student must be studying towards a Washington Accord Bachelor of Engineering (BE) and their practical work experience must be with an ACENZ member firm.

PRIZE

The top three students will each receive the opportunity to attend the ACENZ Annual Conference and awards with travel expenses paid, a framed certificate and $1,500 cash prize.

AECOM

WINNER
LUKE BOYLE
University of Auckland

WINNER
SARAH NOVIS
University of Auckland

WINNER
ROBYN FINDLAY
University of Auckland

MESSAGE FROM THE CONVENOR

One of the objectives of the INNOVATE NZ Awards of Excellence is to,

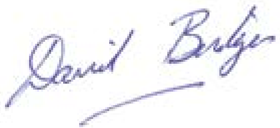
“Encourage high standards of achievement within the engineering industry and associated professions”.

I am always surprised by the level of commitment, knowledge and innovation that New Zealand consulting engineers bring to their clients’ projects. This, the 50th year of the Awards of Excellence is no different. Design innovation, risk management, primary production, bridging and teaching facilities are just a sample of this year’s entries.

It is easy to forget that great projects need great clients and great contractors working collaboratively with the consulting team. I want to specifically acknowledge the very important role clients play in creating an environment which allows innovation to bloom whilst working within time , cost and quality constraints.

I want to acknowledge the commitment and contribution of my fellow judges, they make the Convenor’s task an easy one and it is a real privilege to work with them. Without their tireless commitment there would be no awards.

Thank you to all who have entered awards and congratulations to all award winners.



David Bridges
2015 INNOVATE Convenor of Judges

ABOUT THE INNOVATE NZ AWARDS OF EXCELLENCE

The INNOVATE NZ Awards of Excellence showcase and celebrate outstanding New Zealand engineering excellence and innovation.

The INNOVATE Awards differ from others as the projects are evaluated individually on the merit of each project alone, so there may be more than one award in any of the given categories or none at all.

A project is not awarded a prize (being Gold, Silver, or Merit) for simply being a good project. The work, technology, service, and innovation must go above and beyond what is considered standard operating procedure for the industry.

JUDGING PROCESS

Each year a panel of 25 to 35 judges evaluate projects in teams, each team reading project submissions, conducting client interviews and tours on many of the project sites. This attention to detail accompanied by a thorough investigation by a panel of industry experts is what makes the INNOVATE NZ Awards of Excellence the pinnacle of industry achievement.

Judges consider the technical excellence of the design and execution by evaluating complexity, innovation, depth of technical knowledge, the elegance of the solution, social environmental impacts and the client relationship of each entry.

JUDGING PANEL

Steve Abley
Geoff Banks
David Bridges (Convenor)
Alistair Cattanach
Andrew Charleson
Win Clark
Simon Drew
Herbert Farrant
Steve Gentry
Brett Harries
Steve Jenkins
Richard Kirby
Allan Leahy
Trevor Matuschka
Alec McCulloch
Brent Meekan
Bob Nelligan
Ray Patton
Iain Rabbitts
Ernst Sansom
Michael Simpson
Murray Spicer
Adam Thornton
Derek Smith
Gavin Still
David Voss
Ashley Wilson
Cam Wylie

Top left: *Trevor Matuschka, Herb Farrant, Bob Nelligan, Gavin Still*
Above right: *Richard Kirby, Alec McCulloch, Ernst Sansom*
Bottom left: *Brett Harris, Ray Patton, Iain Rabbitts, Trevor Matuschka, Ashley Wilson, Andrew Charleson*

Left to right, front row: *Andrew Charleson, Geoff Banks, Brett Harris, Ray Patton, Allan Leahy, Ernst Sansom, David Bridges (convenor), Catherine Chong, Alec McCulloch, Bob Nelligan*
Back row: *Ashley Wilson, Michael Simpson, Brent Meekan, Richard Kirby, Gavin Still, Murray Spicer, Simon Drew, Iain Rabbitts*

GOLD AWARDS

Lower Hatea River Crossing

Counties Manukau District Health Board Harley Gray Building

Clyde Quay Wharf

GOLD

LOWER HATEA RIVER CROSSING

WHANGAREI / Novare Design for Whangarei District Council

GOLD

The Lower Hatea River Crossing is an example of outstanding civil construction, as it demonstrates that functionality and aesthetics need not be mutually exclusive. Road bridges are typically built to a cheap design solution, yet the LHRC shows that transport infrastructure can be both practical and striking – and with lateral thinking – economical.

The Transfield Services/McConnell Dowell JV was able to achieve this with their bascule bridge modelled on the traditional Maori Fish Hook Hei Matau – representing strength, good luck and safe travel over water. The bridges form reflects its function as the 'fish hook' (J beams), which is cantilevered and rolls back to raise the bridge deck.

The new 265m bridge connects Whangarei's eastern suburbs with the City's commercial and industrial areas along Port Road and back to the Town Basin, and is part of a package to ease traffic congestion. The project includes 1.26km of new road across the old town refuse facility on Pohe Island, three roundabouts and a three-metre shared cycle lane and footpath. Since opening in July 2013, the bridge now carries over 8,000 vehicles per day.

Community involvement in the project was a key driver for the client, and local input was emphasised and prioritised at every stage. More than 61% of the project's value was spent locally and more than 65,000 local man hours worked. This provided significant stimulation to the local economy – a key project requirement.

Delivered through an ECI contract model, the project demonstrates how collaboration can leverage the skills of diverse groups. Auckland-based consulting engineer Novare / Gaia (formerly Peters & Cheung) led the project team. Novare / Gaia carried out structural and geotechnical design. It included Knight Architects delivering the bridge design and Eadon Consulting providing the mechanical and electrical engineering for the bascule section. Northern Civil Consulting Engineers carried out roading design. The client particularly noted the efforts of Duncan Peters in leading this international team to deliver the outstanding design result.

The Lower Hatea River Crossing is an example of outstanding civil construction, as it demonstrates that functionality and aesthetics need not be mutually exclusive.

GOLD

COUNTIES MANUKAU DISTRICT HEALTH BOARD – HARLEY GRAY BUILDING

GOLD

AUCKLAND / Beca for Counties Manukau District Health Board

The Harley Gray Building is a $124 million 34,000sqm, five storey development that forms the new heart of Middlemore Hospital. This complex building provides 14 new operating theatre suites and all associated clinical services all designed to the highest possible standards and providing space for future expansion.

The very operationally and energy efficient result was achieved through close involvement and input of Counties Manukau District Hospital (CMDH) Clinical Staff and Hospital Engineering Operation and Services staff in the consultant team with Beca who provided design and construction monitoring for HVAC, Medical Gases, Electrical and Fire Protection Services and Fire Engineering.

In addition to the complex services required for the Harley Building, Beca included design for centralisation of core building services which were previously scattered throughout the hospital complex of buildings.

Beca undertook a number of energy consumption optimisation studies incorporating innovative low velocity ductwork design, resulting in considerable reductions in plant energy consumption compared to current standards.

Completed under budget and ahead of programme, this project provides value for money with innovative engineering solutions and long-term durability.

The completed facility provides an enhanced experience for the patients, families and staff serving the people of South Auckland.

Completed under budget and ahead of programme, this project provides value for money with innovative, engineering solutions and long-term durability.

The resultant facility provides an enhanced experience for the patients, families and staff serving the people of South Auckland.

GOLD



CLYDE QUAY WHARF

WELLINGTON / Dunning Thornton for Willis Bond & Co.

GOLD

The Clyde Quay Wharf project was an exciting and challenging project that converted a 100 year old, decaying and earthquake prone wharf into a stunning and high-value premium apartment complex with vastly improved public access space.

Located in an iconic and prominent position on Wellington harbour, visible from much of Central Wellington, the project was always going to be subject to close public scrutiny. The results have been outstanding in terms of public reaction, values achieved for the apartments, and the technical success of a submerged carpark without a single leak.

The structural scope demanded innovative and imaginative solutions to respond to the extreme site conditions, the limitations of the existing structure and the necessity to work within affordable budgets.

The sub-structure (below the wharf deck) was particularly challenging with the heritage concrete wharf, in a very parlous state, requiring preservation and strengthening while at the same time providing durable carparking within the aggressive tidal zone.

The superstructure also had high complexity with the need for unobtrusive structure that had to be coordinated with services and maximised ceiling heights throughout the apartments, while maintaining high seismic and gravity performance with an emphasis on seismic damage avoidance to primary and secondary structure.

Finger wharf redevelopment is known for its commercial risk and the success in this regard is a credit to the project team. Dunning Thornton Consultants played a key role as a trusted advisor to the client throughout the 10 year delivery of this prestigious project from conception, through the RMA and detailed design processes, and with extensive input to the demanding construction challenges.

The results have been outstanding in terms of public reaction, values achieved for the apartments, and the technical success of a submerged carpark without a single leak.

SILVER AWARDS

Waikato Expressway Huntly Section

Cashin Quay 1 Earthquake Repairs

University of Auckland Chemistry Undergraduate Teaching Laboratories

Ara Tūhono - Pūhoi to Wellsford – Pūhoi to Warkworth Planning Phase

PNCC Digester Upgrade

Auckland Manukau Eastern Transport Initiative (AMETI)

Esk River Hydro Power

Taupiri cutting from the north

Huntly Tangata Whenua site inspection

Public Open Day in Huntly

Taupiri Maunga

Bloxam, Burnett & Olliver: A highly skilled team of engineers, planners and surveyors.

Bloxam Burnett & Olliver (BBO) congratulates ACENZ on 50 years of innovation.

BBO is a New Zealand-based multi-disciplinary company of consulting engineers, planners and surveyors, and has built a solid reputation in New Zealand and overseas by providing cost-effective, innovative and practical solutions to complex problems, while consistently exceeding client expectations. Notable examples include the *Northgate Industrial Park* currently under construction at Horotiu, the *PWC Centre*, and *The Base* retail centre in Hamilton.

The *Huntly section of the Waikato Expressway* is one of BBO's flagship projects, and is one of many projects they have been quietly and efficiently delivering, since the company's foundation in 1993, by Martin Bloxam, John Olliver and Reece Burnett. BBO has also played key roles in completing the *Ohinewai*, *Te Rapa* and *Ngaruawahia sections of the Expressway* over the last 10 years.

BBO specialises in the following areas:

Structural Engineering

The BBO structural design team has successfully delivered a diverse range of technically challenging projects throughout New Zealand and Asia.

Civil Engineering

BBO provides innovative and cost-effective designs and solutions to infrastructure projects.

Traffic Engineering

BBO's traffic engineers work within the team to create a seamless 'one-stop-shop' from consenting and modelling, to design and construction.

Planning

BBO is widely experienced with land use, subdivision and large infrastructure projects, consents and designations.

Surveying

BBO has extensive experience in complex industrial and commercial projects as well as smaller residential developments.

Procurement

BBO has assisted the New Zealand Transport Agency to develop a number of innovative delivery models and to implement them to procure large scale, high risk contracts.

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BLOXAM BURNETT OLLIVER
ENGINEERS • PLANNERS • SURVEYORS

www.bbo.co.nz

WAIKATO EXPRESSWAY – HUNTLY SECTION

HUNTLY / Bloxam Burnett Olliver and Tonkin & Taylor for NZ Transport Agency

SILVER

The Huntly Section is a proposed 15.5km four lane expressway to the east of Huntly township, forming part of the Waikato Expressway Road of National Significance. The constructed project will pass through steep and geotechnically challenging terrain and areas of high environmental and cultural value.

Bloxam Burnett and Olliver Ltd collaborated with its principal subconsultant Tonkin and Taylor Ltd, and the NZ Transport Agency, to complete the investigation of the project, develop a Specimen Design and obtain the principal statutory approvals required for construction.

The project team identified an alternative eastern corridor through the central 10km of the project that mitigated significant geotechnical risk, reduced environmental and cultural impacts, improved the geometric standard and resulted in an estimated cost saving of $72 million.

The high level of stakeholder engagement contributed to all statutory approvals being obtained without Council hearing or appeal to the Environment Court. The integration of Tangata Whenua into the project team resulted in their initial strong opposition to the project being transformed into acceptance, if not support. This approach was commended by the State Services Commission which observed that it may well provide a model for future engagement with iwi on similar future projects.

SILVER

CASHIN QUAY 1 EARTHQUAKE REPAIRS

CHRISTCHURCH / Opus for Lyttelton Port of Christchurch

The 22 February 2011 earthquake and ensuing earthquake sequence caused significant damage to the Cashin Quay 1 coal export berth at the Port of Lyttelton. This berth is the only coal export facility in the South Island. Opus International Consultants was engaged by the Lyttelton Port Company to urgently design a new temporary structure to support the 200 tonne coal ship loader and to reinstate the existing berthing and mooring capabilities of the berth; these designs were to comply with stringent insurance constraints as well as meet all relevant requirements of the New Zealand Building Code. Challenging site conditions included ongoing seismic activity and difficult geotechnical conditions caused by a weakened marginal reclamation slope. Physical works commenced in March 2011 and further damage to the existing structure and new contract works was inflicted by the 13 June 2011 earthquake.

The innovative and adaptable approach adopted by Opus was one of the key reasons for the successful completion of the project in April 2012. Throughout the full duration of the project Opus applied innovation not just at a macro project level, but also at design level in order to help meet the technical and insurance requirements.

The design and installation of steel trusses spanning up to 36m, within an 18 day period, to support the ship loader following the 13 June earthquake was an example of collaborative innovation at its best being adopted to achieve a favourable outcome not just for the client, but also for the West Coast communities who would have been severely affected if coal exports were to cease. This project is an example of innovative disaster response engineering at its best.

CHEMISTRY UNDERGRADUATE TEACHING LABORATORIES

AUCKLAND / Beca for The University of Auckland

SILVER

These laboratories are one of the first stages of a significant redevelopment of UoA's Faculty of Science, to provide state of the art research and teaching facilities for 200 students at three teaching levels plus associated preparation storage and teaching spaces.

The existing 1960's building presented a very difficult set of problems for the design and installation of complex ducted and piped services.

Engineers investigation of the structure revealed critical seismic design weaknesses making beam penetrations difficult. These design constraints were overcome by the use of Carbon Fibre Reinforced Polymer strengthening to the structure and penetrations.

Design of multiple ductwork and piped services systems for 58 fume cupboards presented extreme difficulties.

Beca engineers overcame these by the following;

- Achieving regulatory approval for grouping of exhaust air for 24 fume cupboards into common fan duct manifold plenums.
- Differential pressure controls of fan speeds to maintain safe pressure differentials between spaces. Minimum safe ventilation through automatic partial closing of idle fume cupboard doors.
- Use of Revit 3-dimentional modelling system for integration of all ductwork and pipework systems design subsequently adopted by contractors.
- Adoption of new external multiple open framed architectural columns enclosing multiple polished stainless steel fume hood exhaust ducts rising from modular fan plant rooms.

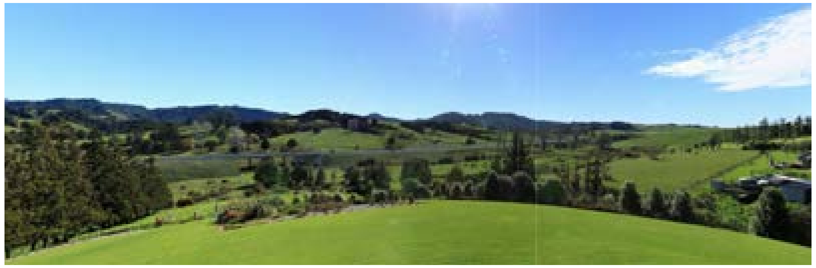
Notable safety features include separation of flammable gases, solvents and oxidants, gas sensor systems, ventilation boost mode and an intuitive traffic light safety system. The final design excels in both innovation and efficiency, delivering an exceptional teaching environment.

SILVER

ARA TŪHONO – PŪHOI TO WELLSFORD – PŪHOI TO WARKWORTH PLANNING PHASE

PŪHOI TO WARKWORTH /

Jacobs, NZ Transport Agency, Chapman Tripp and GHD for NZ Transport Agency



The 38 km Ara Tūhono – Pūhoi to Wellsford Road of National Significance (RoNS) is one of seven RoNS established by the Government on 2009. The first stage of this scheme is the 18.5 km long Pūhoi to Warkworth section (P2Wk).

In 2013 the NZ Transport Agency (the Agency) formed the Further North Alliance (FNA) comprising the Agency, engineering & planning consultancies Jacobs and GHD, and Chapman Tripp Lawyers. The FNA was tasked with obtaining the statutory approvals for P2Wk. An alliance unique in the world with its inclusion of legal non-owner participants, it was created with the challenging objectives of; obtaining designation and consents in record time, achieving flexible, outcome-focused conditions of designation and consent, and setting a new benchmark for the consenting of large infrastructure projects.

The alliance partners worked closely and adopted an innovative and 'norm challenging' approach to many commonly accepted practices associated with the statutory approval process that achieved all the Agency's objectives and stretched targets, and exceeded Client expectations in all respects. Targeted design development and environmental assessments were undertaken to prepare concise application documentation. The application followed a Board of Inquiry process, administered by the Environmental Protection Authority. The expertise and experience of the alliance technical specialists, together with the Agency's exemplary track record of environmental management, combined to ensure success for a project with significant scale and technical complexities.

The Agency believes that the techniques and innovative processes devised and executed by the FNA can deliver significant productivity and cost benefits to New Zealand's infrastructure portfolios, and hence the wider NZ economy. The NZ Transport Agency was not only highly satisfied with the FNA's work, but also in its firm belief in the wider benefits achievable for the nation. This alliance model is now being used on other Agency project delivery.

PALMERSTON NORTH CITY COUNCIL DIGESTER UPGRADE

PALMERSTON NORTH /

Calibre Consulting for Palmerston North City Council

SILVER

Palmerston North City Council (PNCC) had the vision to increase the amount of digester gas produced by their wastewater treatment plant. Calibre Consulting proposed a capacity upgrade of the existing digesters by installing new technology for efficient co-digestion of fat, oil and grease (FOG) rich waste (dairy factory sludge, grease trap waste).

The PNCC Digester Upgrade added the ability to divert and digest approximately 15,000 tonnes/year of high FOG content trade waste from landfill at total investment costs of only $1.5 million; $2.5 million less than expected for alternative construction of two additional digesters. The digester upgrade project was completed in 2012, the produced biogas is used for co–generation and the potential to export electricity into the grid (700kW generator).

The key to increased capacity was separation of digester hydraulic and solids residence time of the existing digesters by adding internal recuperative thickening (RT). This was the first installation of its kind in New Zealand. Design, implementation, waste selection and procurement of trade waste was realised through the close cooperation of PNCC, Calibre Consulting and Palmerston North City Networks.

The new process tolerated increased FOG loading rates that would normally inhibit biogas production. High biogas yields, low trade waste treatment costs and significantly increased biogas production were achieved. Operation for three years with process advice by Calibre Consulting confirmed digester process robustness and low operation costs.

SILVER

AUCKLAND MANUKAU EASTERN TRANSPORT INITIATIVE (AMETI) – PHASE 1

AUCKLAND / Opus & Beca for Auckland Transport

The AMETI Phase 1 project has delivered a key piece of high quality travel infrastructure for eastern Auckland that includes a new integrated public transport interchange at Panmure which incorporates a new station building, the raising and replacement of both the Ellerslie-Panmure Highway bridge and the Mountain Road bridge, construction of a new bridge for the busway parallel and adjacent to the Ellerslie-Panmure highway bridge, a new 1.5km road (Te Horeta Road) with two new signalised intersections, future-proofing for a third rail line, a footbridge, walking and cycling facilities, and improvements to the urban realm.

Unique features of this complex and difficult urban project include the 225m long road tunnel with a local road constructed on top, the landmark public transport interchange which provides seamless integration between a new bus transfer station on Ellerslie-Panmure Highway, a rail station below, and multiple levels of surrounding roads, footways and cycleways. Also incorporated into the project are major enhancements to Van Damme's Lagoon to create both a stormwater management feature, and an accessible and attractive public recreation space and ecological reserve.

The multi-modal interchange provides the first stage of a segregated busway that will eventually run for over 6 km from Panmure to Botany, and is the first of its kind in New Zealand, and one of few worldwide, to achieve such seamless integration of modes.

Opus, in partnership with Beca, completed preliminary and detailed design and construction supervision. Successful consultation and engagement with the community, iwi and key stakeholders was undertaken along with obtaining all necessary consents and designations. The consultant and client team initiated and designed a number of significant enhancements to the scheme stage design, resulting in substantially better project outcomes for the community.

Fletcher Construction was the lead contractor for Phase 1. The new bus/rail interchange opened in January 2014 and the Te Horeta Road opened in November 2014. Prior enabling works, including the construction of a replacement bridge at Mountain Road, were completed by Downer in 2013.

ESK RIVER HYDROPOWER

NAPIER / Jacobs for Trustpower Limited

SILVER

The Esk Hydro Project is located at the headwaters of the Esk River, Napier. The scheme comprises two separate high head mini-hydro schemes. Drawing from separate tributaries, the two schemes provide a combined output of 3.8 MW, and achieve 15.6 GWhrs per annum.

Both schemes are remote and difficult to access, up steep and unstable terrain. To enhance the viability of the schemes, access roading development was minimised and detailed geotechnical investigations were restricted to dam sites, power houses and only where considered necessary for penstocks with engineers, client and contractor working in an informal risk sharing arrangement. Where pressures are lower penstocks are rubber ring jointed glass reinforced plastic (GRP). Where pressures are higher and in steep and unstable sections welded steel pipes are used. Specially designed thrust blocks were used where penstock bends were necessary and at pipe material joints. The longer of the two penstock routes is 2.8km from the dam to the powerhouse.

Minimal access roading development required innovative methods of sledging and bucketing materials and equipment to power houses and dams construction.

The resultant viable scheme has been achieved by economical, practical engineering and construction for low capital cost. It has virtually no impact on the environment and provides continuous renewable energy for up to 2,000 homes.

ME

MERIT AWARDS

Project Rimu

Haven Road Substation

Knox Church Rebuild

Victoria University of Wellington Campus Hub

Trimble Navigation’s Office

Hagley Oval Pavilion

Point Resolution Bridge

PROJECT RIMU

WAITOA /

Beca, Tetra Pak NZ and Ebert Construction for Fonterra Co-operative Group Ltd

Project Rimu is a $126m capital build project involving the design, construction and commissioning of New Zealand's largest UHT milk processing and packaging site adjacent to Fonterra's Waitoa site. The new facility is largely built as a greenfield site, however utility services such as steam are supplied from the adjacent existing site infrastructure, requiring significant brownfield engineering and construction activity. The team was set the challenging milestone of completing the project within a 12 month period, to ensure projected sales growth could be realised.

In addition to the operational, production and programme goals for the new facility, the project team set themselves the aspirational objective of setting the benchmark for how large scale dairy projects will happen in New Zealand.

To achieve this goal it was clear that a step change in how the project was run and managed would be required. A collaborative approach was needed where all parties worked together on a best for project outcome basis. To facilitate this collaborative approach a project leadership group was established, comprised of key representatives from Fonterra, Beca, Tetra Pak and Ebert.

This project successfully met all of its key objectives through excellent planning, collaboration and commitment, underpinned by the leadership approach – setting a benchmark for future projects in the industry.

HAVEN ROAD SUBSTATION

NELSON / Jacobs for Nelson Electricity Limited

MERIT

Nelson Electricity Limited (NEL) needed to replace its original outdoor substation, built in 1959, with a new high voltage substation complex to service the increasing power needs of Nelson City, providing reliable and safe power to businesses, residences, and city infrastructure.

The full scope of new substation equipment was developed between Jacobs and NEL and included new power transformers, 33 &11kV switchboards, load control plant, a back-up diesel generator, and control and electrical protection devices. The equipment was enclosed in a building complex involving 17 individual rooms, built on the same site.

This was a challenging project and unusual for a New Zealand utility company, to let an EPCM (Engineering, Procurement, and Construction Management) contract to an engineering organisation to construct the substation. Normally substations are built using the utility's own staff, design consultants and separately, contractors for construction.

The services included engineering involving concept and detailed design from electrical, geotechnical, civil, structural, and mechanical building services disciplines. Jacobs procured all equipment from international suppliers and managed the construction through a civil & building contract to IMB Construction and electrical installation and commissioning contracts to ElectroNet Transmission and Delta Utility Services.

The final design fits in with the environment and emits minimal noise. Other key features of the design include: a substation-specific electrical and physical arrangement to enclose all equipment in the minimum footprint, use of quality and proven equipment.

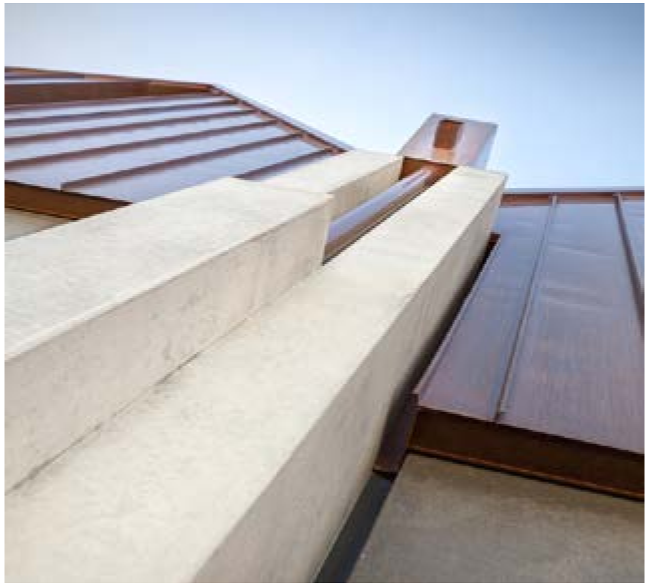
Significant engineering challenges were overcome such as mitigation of fire risk through several techniques, upgrading to fast and secure protection systems using an existing communications link, power system analysis and protection settings to cope with mutual coupling of parallel lines and high and low voltage cable reticulation through the large substation.

The result is a new indoor substation that will cater for Nelson's long term electricity demands and will provide increased security of supply.

MERIT

KNOX CHURCH REBUILD

CHRISTCHURCH / Aurecon for Knox Presbyterian Church



The rebuild of Knox Church (originally built in 1902) presented quite a unique set of challenges. The Christchurch earthquake of February 2011 all but destroyed the triple brick exterior gabled walls of the neoGothic style Church, standing prominently on Bealey Avenue. Left standing was a rich timber interior roof structure tottering on slender timber posts with effectively no remaining seismic resistance. Acting initially for the insurer, Aurecon reacted quickly to arrange temporary bracing within the building adequate to brace remnant structure for the coming aftershocks. Even in haste they were able to remain sensitive to the historic value of the timber columns.

In the aftermath of the earthquakes the congregation resolved to rebuild a church incorporating the original roof and the form of the building. They settled with their insurers and engaged Aurecon to work with architects Wilkie + Bruce to create a building that is sympathetic to and reflective of the original. Aurecon proposed a resilient low-damage avoidance philosophy incorporating new technologies to protect both structural and non-structural elements from future, irreparable seismic damage. This took the form of rocking, post-tensioned precast concrete cantilever columns that were located in the same locations of the old brick buttresses. The rocking columns incorporate replaceable energy dissipaters at the base of the columns to absorb seismic energy in two orthogonal directions.

Construction smarts included temporary support of the roof structure while new foundations were constructed below and post-tensioning the precast columns to partially precast foundations off-site, avoiding difficulties of on-site column tensioning with the roof already in position.

Aurecon worked collaboratively with the client, architect and builder to retain the important heritage interior while creating a stunning new and resilient exterior, reflective of its original iconic form. The newly repaired Church looks better than ever and likely to last another 100 years and beyond. The client and local community are thrilled with the result.

VICTORIA UNIVERSITY OF WELLINGTON – 'THE HUB'

WELLINGTON / Beca for Victoria University of Wellington

MERIT

Key elements of the project success were the integrated design vision ensuring alignment of cost effectiveness and sustainability goals. Close collaboration between VUW, Athfield Architects, Architectus, Dunning Thornton Structural Engineers and Beca ensured integration of architectural drivers and sustainability features, fundamental to creating an exciting, high performing, light space that is highly used by all.

The hub project set out to provide a focal point to integrate the surrounding buildings and services. In particular, the air conditioning and natural light are skillfully integrated to emphasise the architectural vision.

The project transformed an under-used, semi-open 'quad' space into a welcoming and well-connected heart of campus. The project comprised the refurbishment and interconnection into the Rankine Brown Library, Easterfield and Maclaurin Buildings, the new Hub, and the new Tim Beaglehole Courtyard. An operational university is a unique challenge; ensuring the student experience does not become one of 'studying on a building site'.

Key elements of the project success were the integrated design vision ensuring alignment of cost effectiveness and sustainability goals. Close collaboration between VUW, Athfield Architects, Architectus, Dunning Thornton Structural Engineers and Beca ensured integration of architectural drivers and sustainability features, fundamental to creating an exciting, high performing, light space that is highly used by all.

VUW has an Environmentally Sustainable Design (ESD) policy, and the project team chose a 'whole building' approach, integrating engineering and architecture to take into account whole of life cost. An ESD Report was produced at project onset, and updated as design progressed.

On warm, still days the large north facing doors open to create a stunning outside connection. An interlock with the unobtrusive displacement ventilation system, shuts down to save energy. A night purge facility introduces cooler air to cool exposed concrete elements. Extensive wifi coverage and power points enable flexible work. Natural daylight is maximised throughout. Building services are unobtrusive and flexible, leading to better efficiency.

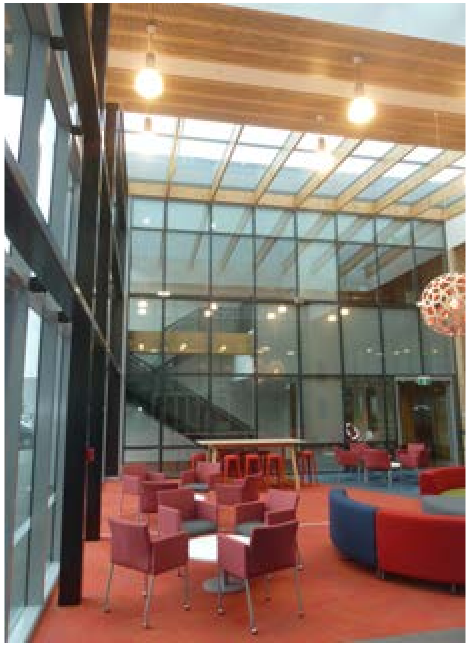
The façade exceeds the minimum building code thermal envelope requirements. Computer simulation modelling was used to test efficiency options such as optimum façade and glazing systems. External solar shading on the north façade optimises daylight and reduces heat and glare from direct sun. The air conditioning is a displacement ventilation system, reducing energy consumption, resulting in reduced CO^2 emissions compared with natural gas fired boilers.

All pumps and fans have variable speeds, adjustable lighting is used throughout, and motion detector control is used, all saving further energy. The circulation stairs are designed to promote visible, open, safe and attractive stairs as alternatives to lifts.

MERIT

TRIMBLE NAVIGATION'S OFFICE

CHRISTCHURCH / Opus for Birmingham Drive Property Ltd



Trimble Navigation's new office replaces their previous one that was damaged by the Canterbury earthquakes and subsequently razed by fire in May 2011. The design delivers on the owner's (Birmingham Property) and the tenant's (Trimble Navigation) key requirements for sustainability, resilient seismic performance, innovation, flexibility and economy. It delivers a structural system that sets a benchmark for rebuilding in Christchurch using sustainable timber products to achieve a high performing but affordable, earthquake-resilient building.

This has led to national and international recognition with IStructE Judges commenting that this building, *"...pushes the boundaries of earthquake resilient timber design and continues the research into performance based solutions that are both sustainable and economic. The judges were impressed by the quality of innovative and unobtrusive detailing, combined with an approach that allows easy replacement of deformed energy dissipation elements and a rapid post-earthquake return to functionality."*

Comprising over 6,000m^2 of office space over two levels, Laminated Veneer Lumber (LVL) Pres-Lam frames are used in one direction with Pres-Lam walls in the other to resist seismic loads. Pres-Lam systems use large sections of pre-fabricated LVL to construct structural frames or walls, which are connected together on site by post-tensioned steel strands, often with the inclusion of mild steel energy dissipators at the member joints. The walls and frames 'rock' in a large earthquake and, as the joints open, elastic strain energy is stored in the post-tensioned steel strands and is then progressively absorbed by mild steel dissipators that cross the joint. This system provides high levels of hysteretic damping and once the shaking stops, the remaining stored energy returns the building to a vertical position with negligible damage to the structure.

This is the first time that Pres-Lam frames and walls have been used together in a commercial building to produce a damage-limiting structure. This has extended the application of this structural system and related timber technologies, demonstrating that it is possible to economically deliver commercial offices that also offer a higher than normal level of seismic resilience.

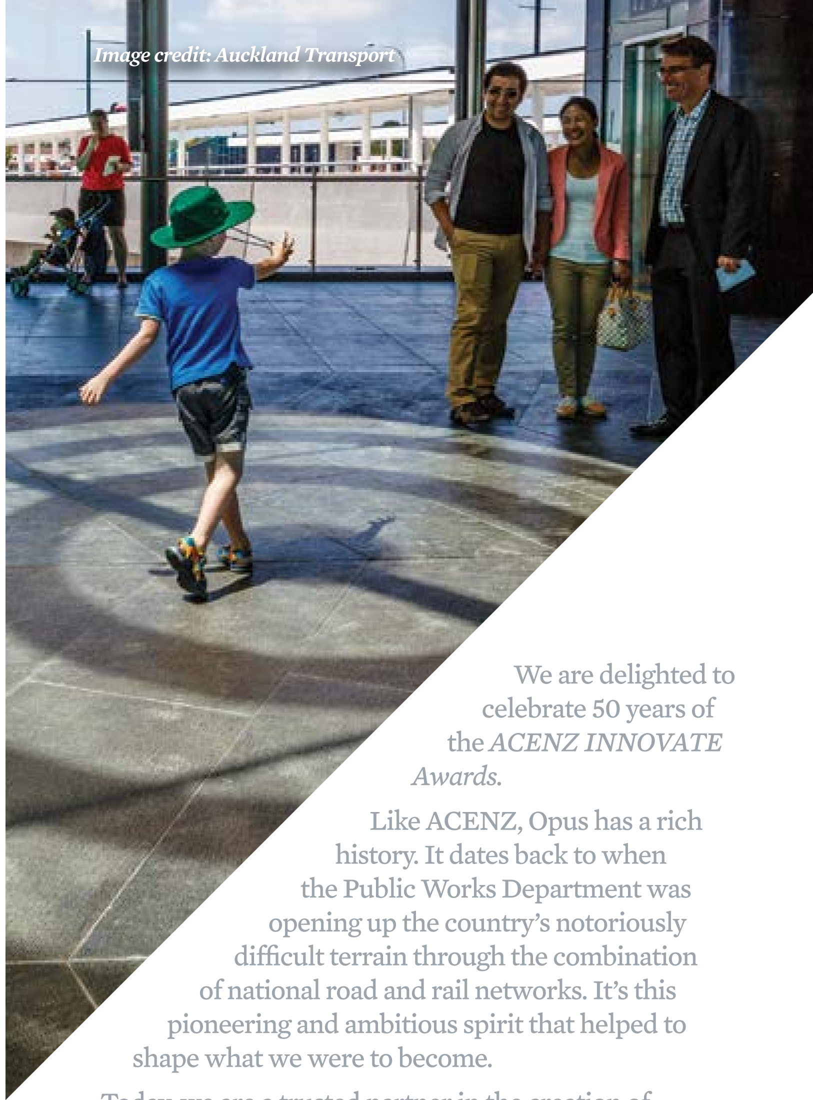


Image credit: Auckland Transport

MERIT

HAGLEY OVAL PAVILION

CHRISTCHURCH / Cosgroves for Canterbury Cricket Trust

Cosgroves Ltd was the Building Services Engineers for the Hagley Oval Pavilion Project including the fire engineering design. The fire design required innovative solutions to address the unusual "fabric tent' design, the multi-use activity, and high occupant densities. The design solutions also needed to consider tight project budgets, programme constraints and the new Fire Code (NZBC).

The Hagley Pavilion includes a double layer of open roof fabric that presents compliance difficulties including surface finish limitations for spread of fire, challenging placement of fire detection systems, and protection of systems against environmental effects such as wind and external moisture.

Innovation was needed in approving suitable fabrics, use of aspirating and linear fire detection systems, and allowing an open aspect for the main function and lounge areas without compromising security or limiting flexibility of use. A key aspect of the architectural design was to maintain clean surfaces over the fabric ceiling and roof. An innovative 'pouch' system was developed to contain the linear thermal wire. This is understood to be the first containment system of this type in New Zealand.

It was critical during the recent ICC Cricket World Cup that there was minimal risk of disruption of the events due to fire systems and the building maintained the impression of a tent structure with a 'village green' effect. The fire design successfully met these objectives.

POINT RESOLUTION BRIDGE

AUCKLAND / Novare Design for Auckland Council

MERIT

The Point Resolution Footbridge is a beautiful and gallant landmark to the Auckland waterfront in an iconic location bordering the Waitemata harbour. It connects a headland, one of the early settlement sites on the isthmus, with a harbourside drive, while providing additional linkages for pedestrians and cyclists to the Parnell Baths.

A simple but sculpted and hull-like concrete deck extends from the headland and protrudes out into the harbour. This in turn is cradled by a highly expressive steel armature or exoskeleton which sinuously references the language of the baths beyond. A simple cantilevered glass balustrade co-planar with the concrete deck provides barrier protection.

From the slender steel piers to the beautifully textured deck to the unique seismic design philosophy, innovation has been the hallmark of the Point Resolution Footbridge design.

This bridge is an exemplary piece of architecture and engineering collaboration with a slender and harmonious form. The sophistication and complexity of the engineering solution has redefined the boundaries of architectural constraints to permit this bold piece of civic infrastructure. The structural engineering solution provided by Peters and Cheung (now Novare) for separate load paths for lateral, torsional loading and vertical loadings, permitting extraordinary slender columns. The structural modelling of complex architectural forms and fabrication of three dimensional components was seamlessly delivered as a first for New Zealand, by direct digital exchanges of Architectural renderings between engineer, architect and fabricator. This was an exhaustive iterative process that the Client noted required considerable tenacity to achieve the desired outcome.

FINA

ALISTS

Wynn Williams House

Christchurch Mayoral Flood Taskforce

Waikato Expressway Ngaruawahia Section - Waikato River Bridge

New Plymouth Wastewater Treatment Plant

Mapua Wharf Wastewater Pump Station

Young Hunter House

Picton Wasteawter Outfall

Cable Bay Road Remediation

Ballance Agri-Nutrients Acid Plant Deconstruction

Hewitt Residence and Showhome

New Zealand Blood Service South Island Blood Centre

Wynn Williams House

CHRISTCHURCH / Ruamoko Solutions for R A Owen & Valinor Trust

This new six-storey building on the edge of Christchurch's CBD, replaces the concrete 1930's eight-storey building known as St Elmo Courts which was demolished in April 2011 after suffering significant damage in both the 2010 and 2011 earthquakes. The structural design of this project combines base isolation and post-tensioned timber and concrete two-way seismic frames to mark a world first in seismic design.

The project's structural elements have been independently used before, but the combination of base-isolation, post-tensioned hold-downs and post-tensioned frames with precast concrete columns and fabricated laminated veneer lumber (LVL) beams make this building unique. These combined elements mean the building will be subject to little or no structural damage following a full code earthquake, an increasingly important feature in Canterbury.

Implementing this design presented Ruamoko with a number of unique challenges, requiring them to develop innovative design solutions. In particular, the use of the post-tensioned timber LVL beams, in a relatively tall building had significant design, fabrication and construction challenges.

This design demonstrates that moderately tall structures can use engineered wood and base isolation - usually considered too expensive - to deliver cost effective construction.

Mayoral Flood Taskforce

CHRISTCHURCH / Jacobs, Aurecon, GHD, MWH, AECOM, Octa, Opus, Bond Construction and Innovate Consulting for Christchurch City Council

Christchurch City Council set up a Mayoral Flood Taskforce in April 2014 to deliver rapid practical help to address the heaviest rainfall since the 1970s, which, combined with damage to the drainage network and land settlement from the earthquakes, caused severe flooding. Many residents still recovering from the earthquakes suddenly faced a second disaster.

This was a unique situation where 12 different organisations (67 contributors) were rapidly mobilised to collaborate to identify causes and find short-term solutions for the repeated flooding in little over a month. The core members dropped existing work to commit to the intense turnaround. The Taskforce, in reaching these objectives, showed superlative achievement in collaboration amongst New Zealand engineering consultancies, client, and contractor.

The Taskforce was executed in two phases of 10 and 29 days. The multi-discipline, multiconsultancy/client partnership included staff from Council, Jacobs, Aurecon, GHD, Aecom, Opus, Innovate Consulting, MWH, Octa, Bond Construction Management, Innovate Consulting, City Care, and Environment Canterbury (ECan). Other associated agencies also gave time freely to assist and advise.

The Taskforce identified innovative methods for temporary solutions. But the true achievement was the community focus, consultation and outcomes which were integrated with, and essential to, these solutions. The Taskforce designed a methodology to assess the most vulnerable people, and communicated potential solutions through both community and one-on-one meetings. The increased community engagement through the Taskforce was a success for Christchurch. Many residents commented positively on seeing engineers in the streets to assess and engage.

Waikato Expressway Ngaruawahia Section – Waikato River Bridge

WAIKATO / Beca for Fletcher Contruction Company

'Te Rehu o Waikato' (the Mist of Waikato), also known as 'The Waikato River Bridge' is a 143m long five span bridge carrying SH1 over the Waikato River. The bridge was built as part of the Ngaruawahia Section (Stage 2) of the Waikato Expressway, under the New Zealand Transport Agency's (NZTA) plans to upgrade SH1 in the northern Waikato region and the Roads of National Significance programme (RoNS). Beca designed the bridge on behalf of Fletcher Construction Company who were the main contractor responsible for delivering the Design and Construct contract to NZTA.

As the Waikato River is sacred to mana whenua, the bridge piers were not permitted within the watercourse. Beca developed a composite steel ladder deck bridge supported on concrete V-shaped piers that enabled a significant reduction of the main river span from 75m to 55m without the need for piers in the river. This reduction allowed for an efficient and slender steel superstructure.

The tapered concrete V shape piers combine with independent steel ties to create an innovative structural form unique to New Zealand. This unique and elegant form has been further enhanced with surface patterns reminiscent of traditional Moko (Maori Tattoos), developed in close consultation with local iwi artists to help connect the structure to the heritage of its surroundings.

Both Beca and Fletcher are proud of the way this elegant bridge fits with the river environment. Local mana whenua groups were involved with the design development and had a dawn blessing of the bridge and celebrated the location with carved pou at each end marking the river below to motorway drivers. In the words of NZTA's project manager, **"the result is an outstanding bridge that Waikato Tainui take great pride in."** Gerry Brownlee (then Minister of Transport) officially opened this section of motorway in December 2013. A shared path underneath the bridge is extensively used for cycling, while many thousands of vehicles cross over the bridge on the expressway each day.

New Plymouth Wastewater Treatment Plant

TARANAKI MWH for Fulton Hogan Ltd

In 2012 MWH New Zealand Ltd. were invited to provide design services to Fulton Hogan as a designbuild venture for New Plymouth District Council for the $9.3M Design-Build Contract to upgrade the aeration system at the New Plymouth Wastewater Treatment Plant. The key objectives of the upgrade were to achieve a more energy efficient treatment plant, provide additional treatment capacity, reduce sludge handling and meet the Consent requirements.

The solution involved the conversion of the existing Carousel process into three distinctive zones (anaerobic - anoxic - aerobic) to operate as plug flow bioreactors. At the heart of MWH's innovative design was a highly efficient combination of high speed centrifugal blowers, fine bubble diffusers and control system which significantly reduced power consumption and increased the plant's capacity. A range of enhancements were also made to increase the hydraulic capacity of the plant allowing all predicted wet weather flows to pass through the biological treatment process.

Utilising its global expertise in aeration efficient process design, alongside local expertise in biological process modelling and hydraulic modelling, MWH produced a robust and novel alternative to achieve and exceed the Client's objectives for additional capacity and efficiency.

MWH's innovative approach to the assessment of blowers accounted for ambient conditions and process demands throughout the life of the plant resulted in a selection of an optimum combination of high speed centrifugal blowers. This, together with fine bubble diffusers and an advanced control system, has significantly reduced power consumption by 25% in the first year of operation whilst at the same time increased the treatment plant capacity to serve New Plymouth's predicted population growth until 2040.

Mapua Wharf Wastewater Pump Station

MAPUA / MWH for Tasman District Council

Due to predicted growth and development of the Mapua region in the Tasman district, Tasman District Council required the existing Mapua Wharf wastewater pump station to be replaced. The new pump station was to be constructed within part of the former location of the Fruitgrowers' Chemicals Company, acknowledged as the most contaminated site in New Zealand.

Challenges for MWH included a pump station design which could be constructed without compromising environmental or health and safety standards. To solve this MWH created a design that reduced the amount of excavation and de-watering.

The available construction area was also restricted as the site was part of a proposed waterfront park development for the local community. This required MWH to ensure the design of the finished asset was aesthetically acceptable.

The pump station would also be close to the Mapua Wharf, a popular tourist area so special consideration was required for odour management. Other design challenges included surge pressures of the associated pipelines.

As the history of the site was well publicised, the project was an emotive issue for the local community. MWH and the Council engaged in a rigorous consultation process to agree the final location for the pump station.

To overcome these unique issues MWH developed an innovative design bound by challenging constraints which still provided a cost effective and long term solution for Tasman District Council. In addition, the design reduced the environmental and health and safety risks whilst also ensuring the needs of the community were met.

Young Hunter House

CHRISTCHURCH / Kirk Roberts for Tony and Vanessa Merritt

Young Hunter House (YHH) signifies the first commercial building designed and constructed using innovative multi-storey post-tensioned laminated veneer lumber (LVL), as a low damage, performance based structure.

The independent engineering, undertaken by Kirk Roberts Consulting Engineers Ltd, leveraged the original academic research into pre-cast seismic structural systems (PRESSS technology) enabling the timber industry to compete effectively and gain stronger market access for LVL as a structural solution. YHH subsequently became a reference site for engineers interested in timber technology both locally and internationally.

The Moment Resisting Frames (MRF) themselves have been developed as 'PRESSS' frames, meaning they have been post tensioned along the beam into the column. The post tensioned tendon exerts a compression force through the joint exerting a self-restoring moment pulling the joint and structure back to its neutral position. The steel tendons within the beam act like giant elastic bands pulling the structure back into its neutral position "self-restoring".

The frames beam-column joint has externally mounted energy dissipations on the top and bottom of the beam at the joint to dissipate the energy of the earthquake Post tensioning technology (PRESSS), adaptation to LVL demonstrated a new commercial use for engineered timber and has introduced cost efficiency into the construction process and damage resistance in timber buildings. This has now opened the doorway for timber construction to compete commercially with steel and concrete multi-storey structures.

Picton Wastewater Outfall

PICTON HARBOUR / Beca for Marlborough District Council

CH2MBeca (Beca) was engaged by Marlborough District Council to manage the options assessment, preliminary design, consenting and design of the upgraded Picton wastewater outfall. Beca was also engineer to the construction contract. The Picton Sewage Treatment Plant has produced a consistently high quality wastewater since commissioning in 1999. Prior to 2012, treated wastewater was discharged to an outfall in outer Picton Harbour. However, the above-ground portion of the outfall pipeline was failing and the pipeline would not cater for increased future sewage flows.

There are only limited opportunities for wastewater re-use and a continued discharge to the harbour would be necessary. Several outfall site options were identified and a programme of technical fieldwork and stakeholder consultation was carried out.

A Quantitative Microbial Risk Assessment was prepared to quantify the actual human health risks of a harbour discharge to recreational and shellfish gathering activities. The results showed that the risks from a discharge at any of the outfall site options were negligible.

A mid-harbour outfall was consented for 35 years with the works completed in December 2012 at a design and construction cost of $3.7M, well below the estimated cost of other alternatives initially considered, without compromising public health or environmental values. The upgrade has achieved all client requirements including a cost effective, sustainable outfall that provides for Picton's future growth.

Cable Bay Road Remediation

NELSON / Tonkin & Taylor for Nelson City Council

Following extreme rainfall in December 2011 which devastated and isolated the Cable Bay community, Nelson City Council (NCC) engaged T&T to design solutions to mitigate the risks of future storm events. These solutions needed to:

- be accommodated within the existing road corridor,
- enable community access throughout construction,
- protect the major fibre optic cable route
- be suitable for local contractors to safely and cost effectively construct.

Much of the damage was due to debris flows from slopes above the road, which overwhelmed water courses, inundated the road and caused slumping and collapse of a 3.5km length of retaining walls.

T&T identified 29 sites requiring remediation. Individual design concepts were developed, integrating debris flow channels into retaining walls. Design principles ensured that similar construction methods could be reproduced at individual sites to allow for flow-on efficiencies during construction.

The main contractor, Donaldson Civil, completed works on programme and within budget. NCC acknowledged the unique nature of the project, in particular:

- the scale of damage and vulnerability of the Cable Bay community ,
- the integration of disaster response effort with a successful disaster recovery project,
- the need to develop multiple unique design solutions, and to incorporate them into a single contract enabling systematic and cost effective construction methodologies
- the need for whole community engagement.

The residents noted, *"the road repair was a catalyst for the coming together of the community following the devastation caused by the storm."*

Ballance Agri-Nutrients Acid Plant Deconstruction

WHANGAREI / Beca for Ballance Agri-Nutrients

When Ballance Agri Nutrients turned off their sulphuric acid production plant in Whangarei in mid-2013, they intended to restart it within a few months. However, a subsequent assessment found the 50 year old plant required so many repairs and upgrades that restarting it was not economical. 98% pure sulphuric acid does not corrode steel, but diluted with water it becomes highly corrosive. It is also highly corrosive to skin, regardless of its concentration. The production plant lines were still full of acid, and many parts had accumulated sulphur dust that would turn to acid if mixed with water. It was clear that the deconstruction would need to be exceptionally well planned, so Ballance engaged Beca to manage the project.

Ballance created an internal team to sensitively manage its workforce transition. Beca initiated a risk review process involving the plant owner, operations and maintenance staff, to determine potential risks to the deconstruction team and the actions needed to minimise them.

Culham Engineering Company's (CEC) tender for the deconstruction was successful, because their submission explained in detail how they would manage the key risks. While their submitted price was not the lowest, Ballance could offset the extra cost, as less input would be required from their own team and Beca.

This project successfully delivered smooth workforce transition and no lost time injuries in 12,000 hours work. Ballance, CEC and Beca worked together to achieve this outcome through close collaboration, including open and constructive reviews of all opportunities and incidents.

Hewitt Show Home

CHRISTCHURCH / Kirk Roberts for Daryl and Tara Hewitt

The Hewitt Show Home is a 436 m2 multi-storey architecturally designed home built on a steep and challenging site, offering panoramic views to the Pacific Ocean. Kirk Roberts Consulting Engineers Ltd (Kirk Roberts) was briefed to ensure the architectural aesthetic was not compromised by the absolute requirement to prioritise structural strength and to provide damage avoidance design.

The area of Redcliffs suffered significant land damage during the Canterbury Earthquake. To future proof against land movement in above code level events, a steel and concrete sub floor was designed over a shallow grid foundation system to allow for releveling while protecting against lateral slope movement. Significant concrete retaining walls were also provided.

Primary steel columns remain exposed throughout the house for an urban industrial look which is reinforced by the dramatic exposed steel staircase. The stair is framed above and below by a concentric steel brace frame, showcasing the client's desire for visible seismic resistance. The home also includes concealed steel moment frames and more traditional plywood bracing walls.

The main level features slim lines and cantilevered edges. It incorporates a 237 m2 living area, a level courtyard featuring stone retaining walls and a covered patio with adjustable louvres for outdoor dining.

There is also 109m2 3-4 car garaging and a spacious entry level reception area. The home features the latest in home automation with a range of equipment that can be activated remotely by mobile phone.

NZ Blood Service - South Island Blood Centre

CHRISTCHURCH /

Tonkin & Taylor and Ruamoko Solutions for Ngai Tahu Property Ltd

The South Island Blood Centre is a purpose designed facility comprised of a blood donor centre, manufacturing and testing laboratories along with specialised warehousing and support function offices. The two storey, 3500m2 building was constructed on a 1.2m thick gravel raft due to soft ground and liquefiable soils present at the site.

Large uplift loads on the foundations are expected if a large earthquake was to occur. A conventional foundation solution would have been tension piles, however this carried the risk of piles 'sticking up' out of the ground after an earthquake relative to the rest of the building. Our innovative solution, developed in conjunction with Ruamoko Structural Engineers, was to construct a 'sub-slab' underneath the gravel raft, tied with reinforcing bars to the main foundation. When the building tries to lift up, the weight of the gravel above the sub-slab holds the building down, providing a technically superior and cheaper solution.

T&T were responsible for the geotechnical engineering of the project, in particular development of the ground improvement and foundation solution, assessment of bearing capacity, uplift capacity and foundation settlements. Ruamoko Solutions were the structural engineers, responsible for the foundation concept and design of the foundation slabs and tension connection between the 'sub slab' and the main foundation.

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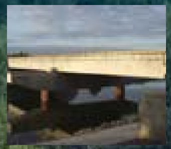
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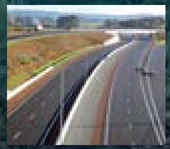
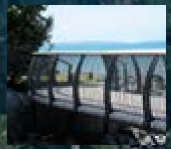

Roading


Infrastructure


Landscapes


Precast


Subdivisions

Bridging the Karapiro Gully: A key structure on the Tamahere to Cambridge Section of the Waikato Expressway. Client: NZ Transport Agency

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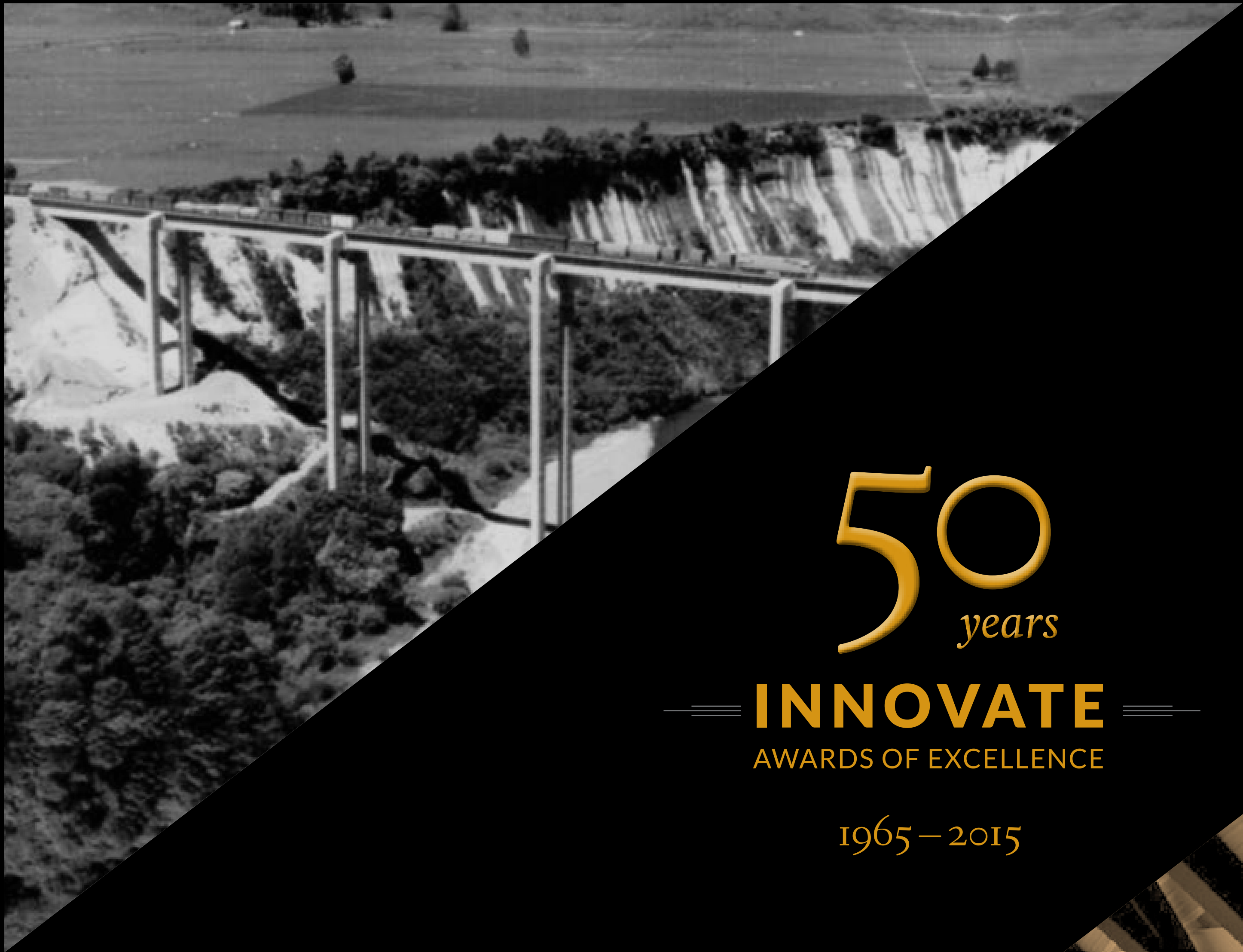

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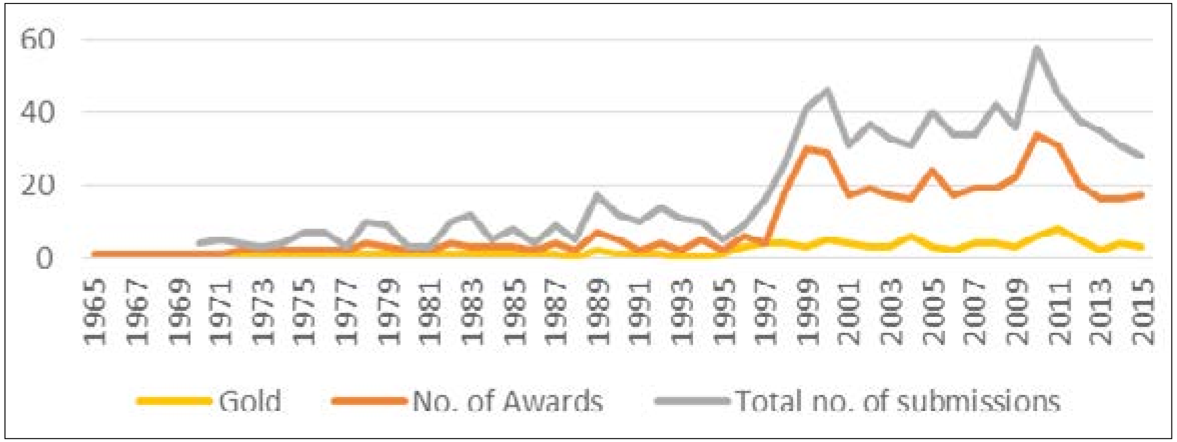
AWARDS OF EXCELLENCE

1965 – 2015

INNOVATE NZ
Awards of Excellence

ACENZ

INNOVATE NZ™ Awards of Excellence, 1965 – 2015



Total No. of Submissions & Awarded Projects from 1965 – 2015

The ACENZ Merit Award Competition, with a premier award being the "Award of Merit", was introduced in 1965 and has become well known within the engineering profession and wider construction industry. From 1965 -1972, there was only one award allocated and it was awarded to only one project.

In 1972, as the result of recommendations from the membership, a second Award "Engineering Excellence Award", was introduced to give recognition to Secondary Adviser work. The name was later considered to be inappropriate in appearing to be superior to the premier "Award of Merit" and also the term "engineering excellence" was considered to be a very difficult classification for the judges to decide upon without an exhaustive study of the entire project data and planning work for each entry.

The ACENZ Management Committee therefore in 1977 discontinued the Engineering Excellence Award and replaced it with the Silver Award of Merit (which was later named the Silver Award of Excellence from 2009 onwards). A Merit certificate (third category) was introduced with a broader base for recognising other meritorious entries.

In 1984, the Gold Award of Excellence title was introduced, replacing the Award of Merit. In 1989, the Award of Merit (third category; not to be confused with the premier award from 1965-1983) was introduced. The name of INNOVATE NZ was introduced and trademarked in 2001.

Today, the ACENZ INNOVATE NZ™ Awards of Excellence are an annual celebration of our industry's outstanding achievements. Engineers play a significant role in our everyday world around us not only as designers but as innovators and problem solvers continuously working towards improving the way we work, live and communicate. ACENZ have been celebrating member achievements since 1965 with AWARDS given only after a robust and in-depth judging process.

The **Gold Award of Excellence,** the highest of the three levels, acknowledges an outstanding project or innovative achievement undertaken by an ACENZ Member or a group of Members acting as either Principal Advisor or as Secondary Advisor.
The **Silver Award of Excellence,** acknowledges projects that clearly demonstrate superior achievement.
The **Award of Merit** recognises projects or achievements that demonstrate a standard above that normally expected.

Project entries range across all consulting disciplines represented by ACENZ members. These include engineering design of structures, infrastructure, industrial processes, project management, investigation and reporting. Each project entry is assessed on the technical excellence of the consultant's work, the degree of innovation and complexity, the level of professionalism and quality of service to the client. Although many awards have been given out over the years (Gold, Silver, and Merit), ACENZ does not allocate a predetermined number of annual awards in any year. Each submission is evaluated individually and there have been years where no gold awards have been issued.

AWARDS MAGAZINE

The inaugural edition of the INNOVATE Awards Magazine was published in 1994/95 to showcase all winners and entries. Gold winners from the first 30 years are featured in this special edition (for the first 19 years they were called 'Awards of Merit' but for consistency are referred to as Gold Winners herein.) Electronic copies of magazines from 1997 on can be requested from the ACENZ office.

Special Messages

It is important that we recognise the enormous contribution engineers have made to society, the economy, the infrastructure and the wellbeing of most nations in the world. Today we rely on good engineering in relation to every aspect of our daily routines: water, roading, buildings and energy infrastructure.

Over the past 50 years, consulting engineers have had to address huge challenges in order to deliver diverse outcomes to the needs of a rapidly changing society. Engineering in the modern world is now just as much about mitigating large risks, cost control, engagement and consultation with local communities, sustainability and resilience, specialist project management skills and computer modelling.

Our member firms projects undertaken in the built and natural environment have contributed greatly to New Zealand building technology, infrastructural developments and quality of life over the last five decades. Our members make up around 95 per cent of New Zealand's consulting engineering firms and represent almost all of the infrastructure design industry involving 10,000 employees. As leaders within our wider industry we reach an extensive network of key people in the public & private sectors, and work closely with all member firms and their clients; we are therefore very gratified to see well deserved Awards being given to our dedicated and committed professionals.

I would like to express my admiration and appreciation for the challenging undertakings of our hard working judges who with their knowledge and attention to detail produce highly respected and robust award outcomes from a field of entries representing the highest quality of our NZ projects. It is also important to acknowledge the outstanding research work of our staff executive Catherine Chong that has made this publication and its content both available and meaningful to the industry.

Kieran Shaw, CEO of ACENZ

ACENZ

To me, the ACENZ Innovate Awards very clearly represent the pre-eminent awards for showcasing the outstanding work carried out by our consulting companies and their extraordinarily talented Engineers and other professionals. This is illustrated by the great number of offices, all around the country, that very proudly display their awards.

I have been fortunate to have been involved both as an entrant and as an awards judge. I won my first award for my '15 minutes of fame', relocating the Museum Hotel de Wheels back in 1993. The recognition that came from that award undoubtedly has helped my career and our practice ever since. Of course, the thrill of getting that award was addictive and encouraged me to keep entering, up to the present day. Recognition by one's peers for the quality of your technical work surely is one of the great accolades for a professional.

I've been on the judging panel since 2004 and that too has been very rewarding, primarily by being able to witness up-close some of the finest professional engineering being done around New Zealand. Being a judge also reinforces the honour of winning an award. The judges are both scrupulous and merciless in ferreting out who and what is worthy of an award. Biggest and brightest pale beside true innovation, excellence of professional service and 'going the extra mile'. I believe the ACENZ awards are unique both in their depth of judging and in that each project is judged on its merits, not against any other.

The ACENZ Innovate Awards are undoubtedly a key cornerstone of our professional culture and have helped promote excellence and the outstanding work we do both within and outside of our Consulting Profession.

Adam Thornton, Innovate Awards Convenor of Judges, 2005-2007

It has been a real privilege and pleasure to have been involved in the ACENZ Award judging over the last 15 years and I thank ACENZ for the opportunity.

The way in which the award entry projects have evolved over time, both in quality and sophistication, has been extremely gratifying to observe, and augurs well for the industry. The breadth and scope of projects now being put forward echoes the evolution that has occurred in the industry as a whole.

The judging process has had to be 'tweaked' over the years to accommodate this ever moving progression, but I believe it is an exceedingly robust system which has proved itself extremely well over time. Excellence is easily recognised, given the process. The judges are all entrants' consulting peers, a fact which seems to have sometimes been lost sight of in some of the entries received, but the submissions themselves have also improved immensely.

I believe the awards are seen by the industry and clients as a true mark of distinction. What firm hasn't got their awards framed and hanging in their establishment for visitors to see? That the awards are celebrating 50 years is a testament to their enduring power to captivate us all.

Steve Gentry, Innovate Awards Judge, 2000-2015

I have been privileged to assist as a judge for over 10 years and have never ceased to be amazed at the quality of work that ACENZ member firms help deliver throughout New Zealand and around the world. I have also been lucky to act as convenor for a couple of years and worked with some of our professions leaders who have offered their wisdom as judges for many years.

An interesting connection for me was being involved in the 40th anniversary celebrations and finding that the first project to win an award back in 1965 was my wife's fathers company - a small firm of consulting civil and structural engineers. It highlighted to me the need to sometimes stop and look back on all that we have achieved as an industry - to really celebrate our successes.

As we enter our second half century, I hope that I can continue to be involved in celebrating great consulting through our awards. Congratulations ACENZ on a marvellous 50 years.

Andrew Read, Innovate Awards Convenor of Judges, 2013-2014

As an ACENZ Board member, I have been chairing a committee looking at the success of the INNOVATE awards this past year. What is striking to me is how ACENZ members, their clients and partners alike all share the same view that the awards are a vital part of the NZ Construction Industry and a marvellous showcase for engineering excellence. The fact that this year is the 50th year of the awards highlights how important they have been in recognising the value ACENZ members bring to clients through engineering excellence. I am have no doubt they will remain relevant to the industry for another 50 years.

Derek McCoy, Chairman of ACENZ Award Committee

ACENZ Innovate Gold* Winners, 1965 –2015

* For the first 19 years all awards were called 'Awards of Merit' but for consistency they are referred to as Gold Winners in this magazine.

Year	Firm	Project
1965	Campbell Hammann & Partners	Millard Stand, Wellington
1966	North Swarbrick Mills & Westwood	Fergusson Bridge, Cambridge, Waikato
1967	PC Marks & Partners	Auckland City Markets, Auckland
1968	Spencer, Hollings & Ferner	Parts Store, Todd Motors, Lower Hutt, Wellington
1969	Stock & Associates	Briscoes Warehouse & Showroom, Christchurch
1970	WG Morrison & Partners	Aurora House, Wellington
1971	Gillman, Garry, Clapp & Sayers	Te Rapa Milk Powder Factory, Hamilton
1972	Steven & Fitxmaurice	Sewage Treatment Plant, Palmerston North
1973	Murray-North Partners (J. C. North and R. F. Swarbrick)	Rangiriri Bridge, Rangiriri, Waikato
1974	Newton King O'Dea & Partners	Mangawara River Control Scheme, Waikato
1975	Ian Macallan & Co	Cook Strait Ferry Terminal, Picton
1976	Bill Lovell-Smith, Sullivan Assoc	Queen Elizabeth II Park Sports Complex, Christchurch
1977	Mandeno, Chitty & Bell	Lloyd Mandeno Hydro Electric Scheme, Tauranga
1978	Murray North Partners	Whitiora Bridge, Hamilton
1979	William Hodge	Karioi Thermo-Mechanical Pulp Mill, Raglan, Waikato
1980	Beca Carter Hollings & Ferner	Air NZ No 1 Hangar, Christchurch
1981	Morris & Wilson	Marsden B Offshore Cooling Water System, Ruakaka
1982	Tonkin & Taylor / Leyland Watson & Noble	Aniwhenua Hydroelectric Project, Bay of Plenty
1983	Beca Carter Hollings & Ferner	Mangaweka Rail Deviation Bridges, Central North Island
1984	KRTA Ltd	Tall Oil & Turpentine Distillation Plant, Mt. Maunga-nui
1985	Beca Carter Hollings & Ferner	Nelson Regional Sewage Scheme, Nelson
1986	Beca Carter Hollings & Ferner	Patea Hydroelectric Power Scheme, Taranaki
1987	Ian Wood & Associates	Canterbury Accelerated Pavement Test, Canterbury
1988		NO GOLD
1989	Bruce Henderson Consultants	Tui Industries Vented Tube, Heat Recovery
1989	Beca Carter Hollings & Ferner	Wellington Regional Aquatic Centre, Wellington
1990	J Harrhy, Consulting Engineer	Design of Wellington Police Launch, Wellington
1991	Beca Carter Hollings & Ferner	Air NZ B747 Maintenance Docks
1992	Duffill Watts & King Ltd	Development of Visitor Facilities at Milford Sound
1993		NO GOLD

Year	Firm	Project
1994		NO GOLD
1995	TH Jenkins & Assoc	Wairakei 30MW Turbine IP Casing, Taupo
1996	Holmes Consulting Group	B747 Hangar, Singapore
1996	Leyland Consultants	Tokaanu Power Station Draft Tube Gates, Turangi
1996	Holmes Consulting Group	Parliament Building Strengthening, Wellington
1997	Beca Carter Hollings & Ferner	Sky City, Auckland
1997	Cuthbert Ashmore Ltd	Sky Tower Support structures, Auckland
1997	Tyndall & Hanham Ltd	Milford Sound Underwater observatory
1997	Kingston Morrison	Darajat Steamfield, Indonesia
1998	Alan Reay Consultants	West Fitzroy Apartments, Christchurch
1998	Worley International Ltd	Java West Operations Telecommunications Systems
1998	Beca Carter Hollings & Ferner	Sky Tower, Auckland
1998	Beca Carter Hollings & Ferner	Auckland International Airport Extensions
1999	Beca Carter Hollings & Ferner	Mercury Energy, Emergency Overhead Transmission Line, Auckland
1999	Beca Carter Hollings & Ferner	Thorndon Overbridge Seismic Retrofit, Wellington
1999	Ove Arup Partners	Canterbury University Maths & Statistics Building
2000	Opus International	Adidas Rugby Institute, Palmerston North
2000	Holmes Consulting Group	WestpacTrust Stadium - Wellington
2000	Tyndall & Hanham Ltd	Nevis High Wire Bungy, Queenstown
2000	Beca Carter Hollings & Ferner	Otira Viaduct & Approaches, Arthur's Pass
2000	Beca Carter Hollings & Ferner	Runway R2A Pavement Rehabilitation, Auckland
2001	Beca Carter Hollings & Ferner	Wellington International Airport Terminal
2001	Beca Carter Hollings & Ferner	Auckland Harbour Bridge Seismic Assessment & Retrofit
2001	Sinclair Knight Merz	Leyte Geothermal Power Project, the Philippines
2001	Meritec	Second Manapouri Tailrace Tunnel: Temporary Bulkhead, Fiordland
2002	Beca Carter Hollings & Ferner	Derceto (software) – Energy Cost minimisation System for Water Distribution, Wellington
2002	Beca Carter Hollings & Ferner	Macau Tower & Convention & Entertainment Centre, Macau
2002	Opus International	Candy's Bend to Starvation Point SH73, Arthur's Pass
2003	Beca Carter Hollings & Ferner	Auckland International Airport Taxiway to Runway Conversion & R3 Reconstruction, Auckland

Year	Firm	Project
2003	Connell Wagner Ltd & Alan Reay Consultants Ltd	Jade Stadium Redevelopment, Christchurch
2003	Bycroft Petherick	New Plymouth Water Supply Bridges
2004	Beca Carter Hollings & Ferner; and Opus International Consultants	Britomart Transport Centre, Auckland
2004	MWH New Zealand Ltd	Development of the Milk Price Industry Model
2004	Babbage Consultants	Fonterra Edendale Drier 3, Southland
2004	Beca Carter Hollings & Ferner	Grafton Gully Project, Auckland
2004	Tyndall & Hanham	Kawarau Bungy Centre Building & Viewing Decks, Queenstown
2004	Beca Carter Hollings & Ferner	Sky City Casino, Level 3 Gaming & Bar, Auckland
2005	Sinclair Knight Merz	Central Motorway Junction Upgrading: Scheme Assessment, Auckland
2005	Tonkin & Taylor	Oriental Bay Foreshore Enhancement Project, Wellington
2005	Alan Reay Consultants	Trusts Stadium, Waitakere City
2006	RJ Nelligan & Associates	Arena Seat Lifting Machine – Telstraclear Pacific Events Centre, Manukau, Auckland
2006	Beca Carter Hollings & Ferner	Auckland International Airport, Pier-A Passenger Segregation, Auckland
2007	Holmes Consulting Group	Auckland Museum Grand Atrium Project
2007	Tonkin & Taylor	Kate Valley Landfill, North Canterbury
2007	Beca Infrastructure Ltd	New Rewa River Bridge, Fiji
2007	Dobbie Engineers Ltd	Tauhara Geothermal Heat Plant, Taupo
2008	MWH New Zealand Limited	Dunedin Airport Groundwater Heat pump Energy System
2008	Beca Infrastructure Ltd	Melbourne Airport A380 Runway Widening
2008	Dunning Thornton Consultants Ltd	Meridian Building: Site 7 Kumutoto Plaza, Wellington
2008	Holmes Fire & Safety	Sovereign House - Fire Engineering, Auckland
2009	URS NZ Ltd and Tonkin & Taylor Ltd (on behalf of The Northern Gateway Alliance)	Northern Gateway Toll Road, Northland
2009	Beca	Owen G. Glenn Building - University of Auckland New Business School
2009	Holmes Consulting Group	Wanganui District Council Bridge 47, Mangamahu Road

Year	Firm	Project
2010	Dunning Thornton Consultants Ltd	Chews Precinct, Wellington
2010	Aurecon	Hautapu Lactose Evaporator Project , Waikato
2010	Tonkin & Taylor Ltd	Kawakawa Bay Landslip Remediation, Manukau City
2010	Sinclair Knight Merz Ltd	Kawerau Geothermal Power Station: Steam Separation System, Bay of Plenty
2010	MWH New Zealand Ltd	Project Storm 2, Auckland
2010	Good Earth Matters Consulting	Waimakariri Flood Protection Project, Canterbury
2011	Beca	Auckland Harbour Bridge Box Girder Strengthening
2011	Beca	New Lynn Rail Trench & New Lynn Station, Auckland
2011	AECOM, Aurecon, Tonkin & Taylor & McConnell Dowell	Rosedale Wastewater Treatment Plant Outfall Tunnel, Auckland
2011	Aurecon	Silver Fern Farms Bubbling Fluidised Bed Boiler, Balclutha
2011	Aurecon & Holmes Consulting Group	USAR Specialists: Response To The Christchurch Earthquake, Christchurch
2011	Dunning Thornton Consultants Ltd	Waitomo Caves Visitor Centre, Waitomo
2011	Sinclair Knight Merz & Opus International Consultants Ltd	Wastewater Network Strategic Improvement, Auckland
2011	Sinclair Knight Merz & Aurecon	Watercare Project Hobson, Auckland
2012	Beca	Alan MacDiarmid Building, Wellington
2012	Holmes Fire	Britomart East / Westpac Charter House, Auckland
2012	MWH New Zealand	KiwiRAP Star Ratings
2012	Tonkin & Taylor	Land Damage Assessment Team, Christchurch
2012	Beca	RNZAF P-3K2 Orion Radar Trainer, Whenuapa
2013	NGA Alliance Design Team-Beca, Tonkin & Taylor, URS NZ, and Boffa Miskell	Newmarket Viaduct Replacement Project, Auckland
2013	Beca	University of Auckland PC3 Laboratory
2014	Holmes Fire	Auckland Art Gallery
2014	Beca	Christchurch International Airport - Mechanical Services and Artesian Heating and Cooling
2014	Aurecon	HVDC Pole 3, Wellington
2014	Beca	Wairakei Bioreactor, Wairakei
2015	Novare Design	Lower Hatea River Crossing
2015	Beca	Counties Manukau District Health Board - Harley Gray Building
2015	Dunning Thornton	Clyde Quay Wharf

1965 – Millard Stand, Wellington

by Campbell Hammann & Partners

Athletic Park acted as Wellington's rugby headquarters. The fans – many sitting in the steep, double decker Millard Stand built in the late 1950's – were buffeted by winds from north and south, until June 26, 1999.

Above: The All Blacks rugby team run onto Athletic Park for the last time in June 1999. With the opening of Westpac Stadium, Athletic Park closed and its Māori owners (the Wellington Tenths Trust) used the site for a retirement village. Photograph by Alexander Turnbull Library.

Left: Millard Stand.
Far left: Western Bank spectators watching Wellington defeat Great Britain by 12-8 on June 3, before the erection of the Millard Stand. Photograph by Alexander Turnbull Library.

The construction company Wilkins and Davies began excavations on the Western Bank for the Millard Stand in 1960. When completed in the latter half of 1961 the double-decker stand, costing £160,000, provided 5,300 undercover reserved seats and 6,600 seats on the top deck.

The project, which also involved the construction of toilets at the main Adelaide Road gate entrance and a new entrance through a former coalyard at the southern end of the new stand, was contracted to be completed by May 31, 1961. The stand was officially opened on June 23, 1962 by the Mayor of Wellington, Frank (later Sir Francis) Kitts before the kick-off of an especially arranged Auckland *vs* Wellington encounter.

One problem which emerged early on in the life of the Millard Stand involved the first six rows of the lower deck at the northern end of the stand. Because of the way the upper deck had been constructed, with the southern section stretching out further and providing greater protection from the elements for the spectators seated below, the seats at the northern end in the front of the lower deck were in effect 'uncovered seats.'

These seats, situated between the Number Four stand and blocks H to N of the Millard Stand became officially known as the 'Doug Chant stand'. It was Doug Chant (long-service administrator) who devised the compromise pricing deal for these seats. In a no-man's land between the definitions of covered and uncovered seating these seats provided the closest central view of the action from the Millard Stand and were always sold out early for big matches. The unusual shape of the Millard Stand arose because at least one Adelaide Road resident declined the Wellington Rugby Football Union (WRFU) approach to sell his house before the building project began. That is the reason why the southern end of the top deck of the Millard Stand was tiered downwards, at a lower level than the northern end.

The Millard Stand was named in honour of the long-serving Wellington rugby administrator Norman Millard. He represented Otago in 1911, played for Otago University from 1909-11. From 1919 he was selector-coach of the Wellington team which beat Great Britain 12-8 on Athletic Park on 1930. When he stood down as Wellington selector-coach in 1933, he channelled his energies into rugby administration and his new headmastership of Hutt Valley High School, and later as WRFU chairman for 27 years from 1937. He was New Zealand Rugby Union president in 1942 and WRFU president in 1950.
Source: Athletic Park by Tim Donoghue

Right: The Rugby Weekly's 1962 front page tribute to Norman Millard, with the stand named after him in the background.

1966 – Fergusson Bridge, Cambridge

by North, Swarbrick, Mills & Westwood

The Fergusson Bridge (also known as the Low-level bridge), was named after the Governor-General Sir Bernard Fergusson and was opened in 1964 with a build cost of £41,000. The bridge is situated on Shakespeare Street, Cambridge, adjacent to State Highway 1.

Above: Fergusson Bridge over Waikato River.

The first bridge over the Waikato River in this area was built in 1870. It was built over the Waikato River at Cambridge by armed constabulary. The site was a little downstream of the new bridge. In 1874 there was a disastrous flood. The river rose 25ft in a few hours and swept the new bridge away. The public again had to use a punt to cross the river.

In 1876 a wooden truss bridge was built at a cost of £2,345. This was on the same site as the present new bridge and was 12ft higher than the first bridge. By the end of last century the bridge was deteriorating rapidly and a scheme for a new high-level bridge on the site half-a-mile downstream was proposed in 1899. But it was not until 1907 that it was built. The old bridge was eventually dismantled.

The site of the new bridge is a river channel in a low gorge. At normal flow the width is 93 ft, the depth up to 16ft and the velocity is about 4 feet per second. It was considered that for durability, finish and economy, the bridge should be constructed in pre-cast, pre-tensioned concrete. Inclined piers were preferred since these allowed the use of relatively light girders and avoided construction in the river channel.

Since the bridge would be seen in elevation by the local public as well as travellers on State Highway No 1, good appearance was essential. The “raking” pier design was considered to fulfil this requirement.

The overall length of the bridge deck is 166ft 5in (50m), the width between the bases of the inclined piers is 10ft (3m) and between the intersection of the piers and beams 70ft (21m). The angle of inclination of the piers to the horizontal is 62 degrees. The deck is 43ft above mean summer river level. The reinforced concrete deck provides for two, 12ft traffic lanes and two, 4ft 6in wide footpaths. The deck is cast as a continuous slab and is designed to carry lateral and longitudinal earthquake forces.

Today it is used by high volume of trucks carrying heavier loads. The first major works on the bridge are currently underway (starting May 2015) to allow the structure to carry 50 Max and full HPMV loads. Horizontal and vertical shear strengthening has been designed by Bloxam, Burnett and Olliver to allow for the new traffic loadings.

Source: Waikato Independent April 10, 1962

1967 – Auckland City Markets

by PC Marks & Partners

The £350,000 project is the second successive year a Hamilton firm has won the award (after North, Swarbrick, Mills and Westward won the previous year's for the design of the Fergusson Bridge).

PC Marks & Partners prepared the supporting information for the application to lease the reclaimed land from the Auckland Harbour Board, and New Auckland City Markets Ltd. The project involved building over two acres of reclaimed land in the viaduct basin area of the city, and the building comprises a ground floor with a selling area of over 53,000ft^2 and off-street parking for 142 trucks all able to load at tray level from a raised platform, a basement with parking for 172 cars and company trucks, and an 11,000ft^2 mezzanine floor of offices. A covered walkway connects the mezzanine floor with the existing offices of Turners and Growers Ltd., one of the companies involved.

The previous city fruit and produce markets were built by the Auckland City Council during World War 1, and only minor additions had ever been carried out on them up till the time this design was commissioned, when rapid population expansion over the last 45 years and a higher standard of living had render them complete inadequate and outmoded.

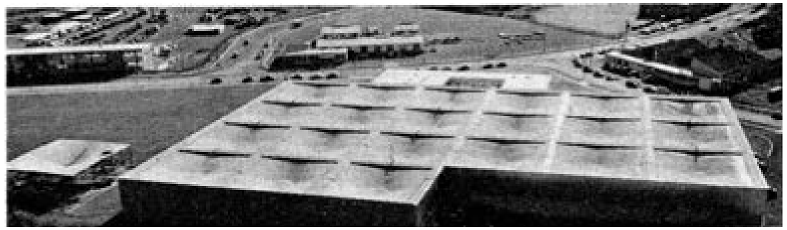
It is currently home to 11 tenants including two popular restaurants. A grand old timer with some stories to tell, in a past life, Xena Warrior Princess was filmed inside its walls. An extensive redevelopment in 1999 set the stage for its new vocation as a central city office and retail hub.

Source: NZ Engineering 1967, www.resene.co.nz.

Above: Once home to Turners and Growers, the old city markets building at 106 Customs Street West, Auckland opened on 1 April 1918 and recently celebrated it's 90th birthday.

1968 – Parts Store, Todd Motors, Lower Hutt

by Spencer, Hollings & Ferner



Above: The formwork for the shell units appears in the left foreground.

In the 1920s, cars were affordable for a wide section of New Zealand's white-collar community and the Hutt Valley became the focus of New Zealand's motor-vehicle assembly industry. The region was chosen because it was central to national markets. General Motors, Ford, Austin, and Todd Motors all built plants in the valley, providing hundreds of jobs. By the middle of the decade New Zealand was one of the most motorised countries in the world.

The Spare Parts Division of Todd Motors in Wakefield Street in Wellington was, by 1961 over 35 years old and very cramped with unsatisfactory access and street parking. Designers Spencer, Hollings and Ferner were engaged to produce a completely fresh approach. A team lead by John Hollings designed a unique concrete umbrella type of construction to be built in the Hutt Valley. The parts store, the first building in New Zealand to utilise a large scale industrial shell roof, was designed to convert to an assembly plant later, if desired.

The main engineering problem encountered was provision of an economical design, a problem made more difficult by the weak subsoils on the site.

A shell concrete roof structure was chosen because its capital cost was no higher than other structural types, and its maintenance costs are about half those for steel-framed buildings. The roof shape is known as a hyperbolic paraboloid and can be made using straight formwork, simply twisted to produce the warped shape. This warping gives the resulting concrete cover its strength. Probably the most famous building of this type is the S.C. Johnson Wax Co. Administration and Research Lab in Racine, Wisconsin, USA, designed by the notable American architect, Frank Lloyd Wright in 1936. The site chosen for Todd's Parts Division 100,000 ft^2 (9,290 m^2) warehouse and office block was at Wingate and covered 7.5 acres (3 hectares).

Photographed by Duncan Winder (Alexandra Turnbull Library)

Only 10% of the total cost was to be in imported materials, a big factor in its factor at that time. In addition it was most cost effective in comparison with a conventional steel framed roof covered in galvanised steel sheeting. Initially there were 22 (a further 8 was added later) 55ft x 57ft (16.8 x 17.4m) umbrella shells, each on its individual central column 24ft 6in (7.5m) above the floor.

The initial teething troubles were many. With the thickness of the roof being only 2 ½ in (64mm), great care had to be used in pouring and curing the concrete. To achieve this, a gang of 40 placers, screeders and finishers worked on each segment using wheelbarrows using full of concrete lifted by crane to the roof. The umbrella moulds were moved with great precision by a 7.25 tonne forklift. Run-off water flowed through the centre pylon to the drains. Since 1961, others have been constructed around the world but the spare parts structure at Wingate was one of the first of this innovative design in the world and on its completion it was the second largest using the paraboloidal shape.

It is currently owned by the Council and occupied by Earthlink which provides work opportunity and support people with mental health issues, learning disabilities or alcohol.

Source: NZ Engineering 1968, 'The History of Todd Park', By Neil Penman.

A bit about the motor industry....

A staggering 20,623 new cars were registered in 1926 alone. Local assemble offered ways of creating both jobs and industries, and Prime Minister Gordon Coates altered tariffs to help promote such an approach. His ideas fell on fertile ground: General Motors opened an assembly plant in Petone in anticipation of the move, and over the next few years plants opened from Christchurch to Auckland. Dominion Motors added a factory in Newmarket in 1935.

The bulk of the industry emerged in the Hutt Valley, where the General Motors plant was joined, in 1935, by a new factory built by Todd Motors. They assembled more than a thousand Chryslers during their first year, then branched into Rootes Group vehicles imported as kits from Britain. They were joined by a plant at Seaview, a 122,000 ft2 operation established by Ford's Canadian arm in 1936. Some 8961 cars and 150 tractors rolled out of this factory in its first year of operation.

When war came in 1936, many of the car plants switched to military production. Munitions poured from Seaview, including 5,720,000 hand grenades and 1,205,400 mortar bombs. The General Motors factory assembled about 1100 Universal 'Bren Gun' Carriers.

Right: Workers in the Hutt Valley General Motors plant buffing a Vauxhall. Note the contrast in style with the contemporary Chevrolet in the background.

Afterwards, British vehicles dominated the field: Ford Consuls, Zodiacs and Zephyrs joined Austins, Morrises, Hillmans, Vauxhalls and Humbers on the assembly lines in the 1950s. A few continental vehicles joined the mix, Volkswagens particularly, along with the diminutive Fiat 500 Bambina – this last model assembled in a factory in Otahuhu.

The industry adapted to Japanese cars from the late 1970s: Todd Motors assembled Mitsubishis, Toyotas were put together in a Thames plant, and other brands in the Motor Holdings plant at Waitara. But the reforms of the 1980s – which deregulated vehicle imports – were a death-knell to the industry, and by the turn of the twenty-first century it had essentially gone.

Source: '*Big Ideas*' by Matthew Wright

1969 Briscoes Warehouse & Showroom, Christchurch

by D. A. Stock & Associates

Right: The retail store was rebuilt in 2012 as it was deemed unsafe after the Feb 2011 earthquake.

In 1882, a tiny branch of Briscoes was established in Christchurch. In 1908, the first "real" store opened in the city, which later moved to Salisbury Street in 1969. At this stage, Briscoes was still predominantly a wholesaler and supplier to the building and hardware industries. Retail was secondary and the relocations were largely to accommodate trade customers who were tired of navigating congested inner city streets. The 28,000ft² warehouse and offices of Briscoes (NZ) Ltd., Salisbury Street, Christchurch is the winner of 1969.

Initial planning of the building, which began in 1966, was for a smaller and different type of structure but this was delayed for 18 months when negotiation took place over the site. Despite the increase in size the finished structure had to remain within the original estimate of costs.

The client's brief demanded a building of low maintenance costs, good thermal insulation, resistance to vehicle damage and minimal risk of burglary. In addition it had to provide for future expansion, undercover loading for customers, and have good natural lighting and ventilation.

To achieve all these requirements, a building of the utmost structural economy had to be provided, so a simple rectangular plan shape measuring 150ft across and 160ft deep was adopted. Undercover loading has been provided by a two-lane roadway passing directly through the centre of the building.

Heating and wind control has been achieved by directing hot air downwards in a curtain above each of the two 24ft wide doorways. These air curtains prevent the entry of winds up to 15m/hr and at the same time provide heat in the large warehousing area. The main outer wall units of the building, which stand over 20ft high and weigh approximately 20 tons each, were cast on the floor, placed in position with a mobile crane, and bolted to the framework of the building. They can be unbolted to allow for future expansion.

One of the most unusual features of the building are the outside office walls, which were designed to create a focal point and complement the rectangular lines of the warehouse area. This has been achieved by specifying half-inch thick asbestos cement panels moulded by the manufacturers to produce a shadow pattern.

Source: Engineering News 1969

1970 – Aurora House, Wellington

by W.G. Morrison & Partners

Aurora House is the largest all-welded structure in high-tensile steel in the Southern Hemisphere and incorporates a five-storey parking building which holds 370 cars, and more than 20,000ft² of office accommodation. The building required about 1,800 tonne s of high-tensile steel, which needed specialised erection and welding techniques. It was constructed for Mayfair Ltd, and was completed in 1969.

Consulting engineers for the project were W.G. Morrison and Partners who, as principal advisers to the client, were responsible for all aspects of planning, construction, and costs. G. Cooper, of Wellington, was the engineer in charge of the project. Structon Group Architects, George Vamos and Partners, and Metlabs (NZ) Ltd were retained as consulting architects, consulting mechanical engineers, and consulting metallurgists, respectively.

The decision to adopt an all-welded steel frame in high-tensile quality steel was taken in the belief that the necessary fabricating resources existed in New Zealand and despite the fact that there was no precedent for an all-welded structure of this magnitude.

The standard of welding and general workmanship achieved in both the shop and the field demonstrated that new materials can be handled satisfactorily by New Zealand fabricators who have the proper technical and physical resources.

The objective of the client was to finance a commercial building development as a profitable investment. The project was developed in several stages to ensure a quick and continuous return on the client's investment. The contracts let were: demolition of existing buildings; excavation; piling; stage one of parking building; stage two of parking building; structural steel frame; balance of superstructure and architecture.

Close co-ordination of each of these contracts both in timing and contractual responsibility was necessary to ensure continuity of construction and progressive occupation.

The windows and internal partitions are additional special structural features and have been separated from the main frame to minimise damage under earthquake loading. At the time when the details for seismic separation of both windows and partitions were under consideration there was no known precedent in this country.

Source: NZ Engineering 1971

1971 – Te Rapa Milk Factory, Hamilton

by Gillman, Garry, Clapp & Sayers

Set on a 50 acre site near Hamilton, the New Zealand Co-operative Dairy Company's Te Rapa milk powder factory, with a processing capacity of 400,000 gallons of milk a day, is the world's largest of its type.

It is a prestige factory, and careful attention has been given to providing the finish and detail appropriate to the manufacture of a high-glass food product.

The programme faced on this project was extremely demanding and the complex, which exceeds $9 million in value, was virtually designed and built in two and a half years. Design was only a little ahead of construction and this introduced immense problems of coordination and briefing. These were accentuated by the complexity of the project, which required buildings and services to be tailored to plant requirements, the details of which the manufacturers were hard pressed to supply in time. Time limitations imposed by a necessity to meet market demands called for design, contractural and constructional approaches out of the ordinary.

One of these was the slipforming of three concrete towers which are the main structural elements of the part of the building housing three spray driers. Each tower, 45ft^2 and over 100ft high, was poured in four to five days. The enclosure between the towers is in structural steel supporting glass curtain walling.

The main elements of the complex are:

- Milk powder factory
- Power house (boilers and turbo-alternators)
- Water treatment facilities
- Mechanical and electrical workshops
- Coal storage and elevating
- Potable water reservoir (500,000 gal)
- Tanker servicing garage
- Effluent treatment
- River water pumping station
- Thirty staff houses and an 18-man staff hostel
- Six acres of yards, 50 chains of roading and 2 ½ miles of under ground drains
- Seven acres of storage buildings (on a separate site)

Three John Thompson water tube boilers with a capacity of 165,000 lb/h at 420 lb/in^2 are placed in the power house. This building is framed in structural steel connected by friction grip bolts and includes three 120 ton clevated steel coal hoppers. The adjacent turbine hall has three turbo-alternators of 3,800kW capacity.

A 22ft by 30ft caisson was sunk 20ft below water level on the bank of the Waikato River to provide a chamber for submersible pumps of 5,000,000 gal/day capacity. These are fed from a sheet-piled approach channel extending into the river.

Source: NZ Engineering 1972

"It was a real achievement to design and build this complex in 27 months. I know of no parallel in New Zealand. It was not done by computers; it was carried out by people who decided they had a job to do and that it was worth doing."
~ L. R. Clapp

1972 – Sewage Treatment Plant, Palmerston North

by Steven & Fitxmaurice Christchurch

The concept and design of the plant was the result of a study and report on the city's future needs for sewage treatment carried out in 1962 by Mr Steven in association with Brown and Caldwell, consulting engineers of San Francisco.

Detailed design work and preparation of contract drawings was carried out by Mr Steven in his Christchurch office, where he also supervised the development of the architectural theme by R. N. Evenden. The contract price for the plant was just shy of $1 million, the principal contractors being J.L. McMillan and Lockwood Ltd., of Palmerston North.

The plant is designed to afford primary treatment to the wastes from a population of approximately 75,000 people. Particular attention was paid to a possible future need to serve a population greater than the original design figure, or to provide a higher quality effluent, or both.

Accordingly, process structures have been sited so as to provide for the duplication of all existing structures and the addition of future process. It will be possible, if the need arises, to extend the present plant to provide secondary treatment for a population of 150,000 without reconstruction of any of the existing process structures.

The plant consists of: influent screening structure; influent pumping station; preaeration and grit removal tank; primary sedimentation tanks; sludge digesters and lagoons, and an administration building.

A feature of the plant is the minimum number of operating personnel. All process and service functions which are not continuous are subject to automatic control and emergency power has been provided against main failure. The plant is unattended 12 hours a day, with an alarm system connected to operators' houses adjacent to the site. Inspection and maintenance is facilitated by the provision of walking galleries which give access to all process and service piping and electrical power and control cables.

The design brief required that influent pumping be continuous, to achieve this the designer adopted an infinitely variable speed pump drive. The pneumatic control system is thus designed to vary the pump speed in proportion to the depth of flow in the influent sewer. The influent pipe thus provides the storage capacity which would otherwise be built into the pumping station with a marked influence on construction economics. It is believed that this is the first time this concept has been adopted for a sewer pumping station in New Zealand.

There can be no doubt that an outstanding feature of this plant is the attention given to aesthetics. The City Council readily accepted the Consultant's recommendation that the plant should be aesthetically pleasing and attention was given to this in the architectural treatment of the administration building and process structures. In addition, high standards of surface finish were sought and obtained.

The net result of this policy has been the acceptance of the plant by the public at large as a public amenity, rather than as something distasteful – which its function might imply.
A further benefit lies in the pride of the operating staff which is well reflected in the meticulous manner in which the plant is maintained.

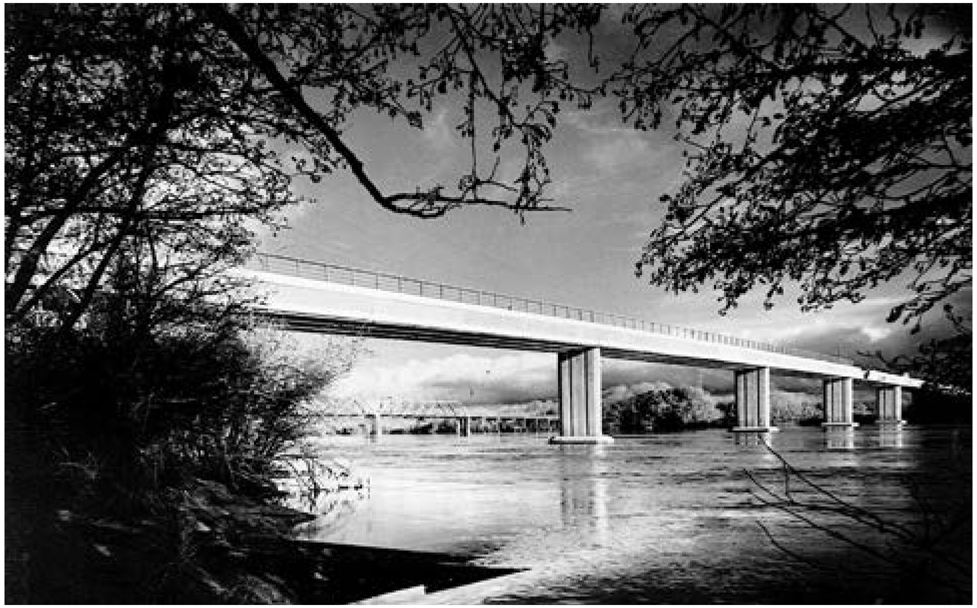
Source: NZ Engineering 1973

Top and bottom left photos: The pre-treatment, pumping block and operations building of the Palmerston North sewage treatment plant. **Bottom right**: Sludge pumping room (between pre-aeration tank and sedimentation tanks.)

1973 – Rangiriri Bridge, Rangiriri

by Murray-North Partners (J. C. North and R. F. Swarbrick)

Right: The Rangiriri Bridge over the Waikato River



The bridge was designed to replace a timber truss structure erected in 1915 to provide a transport link across the Waikato River to the farming community around Glen Murray. The controlling authority was the Raglan County Council. The National Roads Board gave approval for a single-lane bridge only and traffic lights at each end of the structure were necessary to control traffic.

The bridge is 900ft long with eight spans, six of 120ft. The two-cell box girder superstructure was formed by three precast, post-tensioned segmented concrete flanged beams. Construction hinge joints located at points of dead load contraflexure were welded to provide continuous spans for live loads.

The client's requirements for this project called for adequate strength to carry highway loading and other imposed loads, traffic handling capacity to suit the projected needs, durability, minimal maintenance requirements, provision of waterway clearance to achieve flood discharge and navigational requirements, economy and good appearance. In meeting these requirements Murray-North Partners specified a high precast content, including pile cap skirts, piers, beams, and facings.

Other features were live load continuity connection (welded mild steel splices at dead load contraflexure locations) and the formation of box girders from H sections (transverse stressing). The design, detailing and construction supervision of this project led to the successful introduction to New Zealand of an economic method of combining precast concrete units to form a continuous box girder superstructure.

Source: NZ Engineering 1974.

The judges were particularly impressed by three aspects of the winning entry – the technical competence embodied in the design of all elements of the bridge, its admirable and pleasing overall appearance, and the economy of the design.

1974 – Mangawara River Control Scheme

by Newton King, O'Dea & Partners (C. R. Newton-King and A. D. Todd)

In June 1959, Newton-King, O'Dea and Partners were instructed by the Taupiri Drainage and River Board, working under the general direction of the Waikato Valley Authority, to carry out an investigation and to submit proposals for a flood control scheme for the Mangawara River and its tributaries. The project was concerned with the relief of flooding in the valleys of the Mangawara River and the Tauhei Stream. The area concerned lies to the north of Hamilton and on the east bank of the Waikato River. It varies from pratically flat peat land in the south, through alluvial silt valleys to steep hill catchments in the north and east.

The necessity for a scheme of this nature became apparent in the 1950s when flooding was becoming frequent, with an average of about two floods a year causing appreciable damage in the district. When severe rainfalls occurred most of the area in the two main valleys was flooded, and if rain had been general and the Waikato River was in full flood, the lower valley suffered even greater damage.

The scheme adopted was one of channel improvement and stopbanking, designed to discharge the flood flow of the 50-year storms. Works in the first four miles from the Waikato River were limited to willow clearing and one channel diversion, with the bulk of the work occuring in the next 13 miles of the Stream was diverted from its course and redirected into the Mangawara River. Material for the stopbanks was obtained from excavating in the floodways and from a number of channel cuts.

As the capacity of the new work was many times that of the original channel, new bridges were required at most sites. Five new road bridges, four major farm bridges and many smaller farm bridges on tributary streams and drains were constructed.

Above: This aerial view of a section of the Mangawara River control scheme depicts a series of stopbanks-a major aspect of the project. The sacrifice to farmland in terms of additional land being taken up between the banks is more than compensated for by the now certain relief from recurrences of the disastrous floods in the 1950s.

The 16-year project which won the award is of outstanding merit and significant benefit to the community.

The benefit of this project is felt over an area of 26,250 acres and, in addition to the gains to private property, there has been the elimination of flood damage to roads, bridges, river control works and the avoidance of disruption to road traffic. The value to agriculture in general has been considerable.

A scheme of this nature is far from unique in New Zealand, but such undertakings are rarely designed by consultants. The investigation by the consultants was very thorough and it was fortunate that floods in 1960 provided valuable data, and that rain and staff gauges had already been established before the floods took place.

Supervision of the 56 contracts and dealing with farmers on the manifold problems of land acquisition, access, fencing and compensation was an onerous but essential task well carried out.

Source: NZ Engineering 1975.

1975 – Cook Strait Ferry Terminal, Picton

by Ian Macallan & Co

Above: "Arahanga" at No.2 Berth, 1974

The terminal, which handles three million tonnes of freight and 750,000 passengers annually, is an integral component of the New Zealand railway system.
A major port and a railway industrial facility are combined with an essential tourism function in a setting of natural beauty.

The existing No. 1 beth was inadequate for the new vessels in respect of length, fendering, stern buffers and linkspan strength, width and length. The New Zealand Railways considered that at most three vessels could be scheduled through one berth and another berth (No. 3) would be required as a second berth for the larger vessels within 5 to 10 years. Berth Nos 1 and 2 would then be interchangeable except for a top-deck connection on berth No. 1 which would not be required until later.

There were severe site constraints and the need to maintain the existing service without interruption during the construction of No 2 berth and erection of the overpass over highway and rail yards, the conversion of No 1 berth including the subsequent conversion of No 2 berth for larger vessels. Dominant factors therefore were urgency, economy, the limitations of the port itself and the desirability of high standards of public amenity.

TECHNICAL FEATURES INCLUDED:

Fendering – a vessel impact loading of 6,400t gross at 1.2m/s was required and this is very high by normal wharf-design standards, particularly at a point load applied by ship's belting. Dolphins at the head of each arm of the berth transmit the point load from close-spaced perimeter piles through the pile group by suspended, unbolted layers of horizontal timbers at various angles, over the full vertical range of impact, then through double-rubber 600mm dock arch fenders to the rigid wharf behind.

Foundation piles – these were of a type developed earlier for this site, being steel shells with reinforced concrete tip sections for strength and for weight when pitched in water. Difficulties in constructing and driving these piles arose from inadequate cushioning, overdriving while bearing resistance was low and butt welding defects.

Waitohi stream diversion culvert – the low-lying parts of Picton Borough behind the lagoon are prone to flooding and it was difficult to convince the borough council that filling in the lagoon and culverting the streams would not increase this problem. Therefore the hydraulic design was undertaken on a 50-year-flood basis, assuming coincidence of maximium run-off and tide and providing in effect a return period in excess of 200 years.

Linkspans – Open-mesh heavy duty galvanised bridge decking was used for road traffic on both levels and the decking and rail track were accoustically insulated. The shore hinges of rail linkspans were fitted with rubber pads to absorb longitudinal components of live and dead load in thrust and tension.

All the hingers were centred at rail level to avoid conventional fingerjoints in the rails.

Passenger facilities – extended passenger facilities were necessitated by increases in passenger traffic. These facilities included doubling the enclosed terminal building area with provision for a future restaurant floor above, increased carparking area, improved passenger flow for up to 16 connecting buses per sailing, improved baggage reclaim, extensive launch jetty facilities and covered passenger access to No. 2 berth.

Overpass – The single-lane 330m overpass bridge had to be constructed quickly and without interference to road and rail operations beneath it. Aesthetics were emphasised in design owing to the prominence of the overpass from most of the town and port area.

Ian Macallan & Co were also the consulting engineers for the original single berth terminal in 1962, and subsequently for the extensions required for "*Arahura*" in 1984. These projects illustrate many of the capabilities of Ian Macallan & Co, embracing not only port and harbour engineering but also bridging, roading and pavements, rivers and drainage, water reticulation, power distribution and lighting, mechanical equipment design and commissioning, buildings and building services, planning for high density traffic and pedestrian movement and overall project management to achieve tight time and cost constraints.

Source: Engineering to 1990, NZ Engineering 1978.

As he sailed from Golden Bay in 1642, Dutch explorer Abel Tasman suspected that a strait might exist to the east. James Cook discovered it for Europe in 1769 – and these waters soon developed a repute as one of the world's roughest seas, hard on ships and crews alike.

It was also an effective division for some of the nation-spanning engineering works of the nineteenth and twentieth centuries, notably rail.

Rolling stock could be carried with difficulty on ordinary freighters, but New Zealand effectively had to run two separate systems. Visiting British railway engineers Sir Samuel Fay and Sir Vincent Raven promoted a rail-ferry link in 1925, but successive governments felt the cost could not be justified. It was not until the late 1950s that concrete plans were mooted for a roll-on, roll-off rail link between Wellington and Picton.

The comprehensive scheme required purpose-built ships and terminals. The Picton terminal, opened in 1962, was developed by Ian Macallan & Company.

The run was initially serviced by the purpose-built ferry *Aramoana* (picture right). Her first task involved carrying Ab- and J-class locomotives across the strait. The *Aranui* joined the service in the mid-1960s, followed by the *Arahanga* and the *Aratika*.

Age and the pounding of Cook Strait took its toll. By the late 1990s only the *Arahanga* and *Aratika* remained, supplemented by leased vessels such as the *Purbeck* and, during summer months, by so-called 'fast ferries'. These enormous aluminium vessels had a cruising speed of around 34 knots, powered by immense impeller jets – but their rooster-tail wake provoked protests and speeds were restricted in Tory Channel. Nor could they handle Cook Strait's winter seas. Successive 'fast ferries' were leased for the summer months, but all were withdrawn in the early twenty-first century.

The *Aratere* entered service in 1999, replacing the *Arahanga*, to be joined by a former P&O ferry, renamed *Kaitaki* for New Zealand service.

Source: Big Ideas by Matthew Wright

Above: Picton Harbour, with the roll-on, roll-off ferry Aramoana backed up to the linkspan, early 1960s.

1976 – Queen Elizabeth II Park Sports Complex, Christchurch *by Bill Lovell-Smith, Sullivan Associates*

With a capacity of 25,000 people, the sports complex had become a landmark throughout New Zealand not only for what it symbolises in New Zealand's sporting achievements, but also for the uniqueness of its planning concepts and structural forms.

Christchurch was chosen as the venue for the Xth British Commonwealth Games in July 1970 at Edinburgh. Facilities for most of the nine sports existed and needed only minor modifications to meet Games requirements.

However, the matter of venues for the two major sports, athletics and swimming, was the subject of much public debate and discussion, particularly as the full requirements of the Commonwealth Games Federation became known.

The discussion culminated in the decision in October 1971 to build new facilities for both sports at Queen Elizabeth II Park. The consultants were then engaged to plan, design and coordinate construction of a suitable complex to be completed in time for the New Zealand national athletic and swimming championships in November 1973.

Queen Elizabeth II Park is situated 5 ¼ miles north-east of the Cathedral Square in a rapidly developing urban area.

The Park, originally scrub-covered low sandhills and swamp, had been levelled and filled. Test bores revealed approximately 6m of uncompacted sand, with thin peat layers overlying coarse dense sand.

As constructed, the complex caters for athletics, swimming, water polo, squash soccer, greyhound racing and outdoor concerts. The construction falls into two categories: the main structure containing the pool hall with a 50m competition pool, a combined diving/water polo pool and a 33 1/3m training pool, 200-seat restaurant, 2,500-seat permanent spectator stand; 400m warm-up track cover a mass of field tiles, underground wiring, over three miles of 100mm plastic comunications ducting and an automatic pop-up irrigation system.

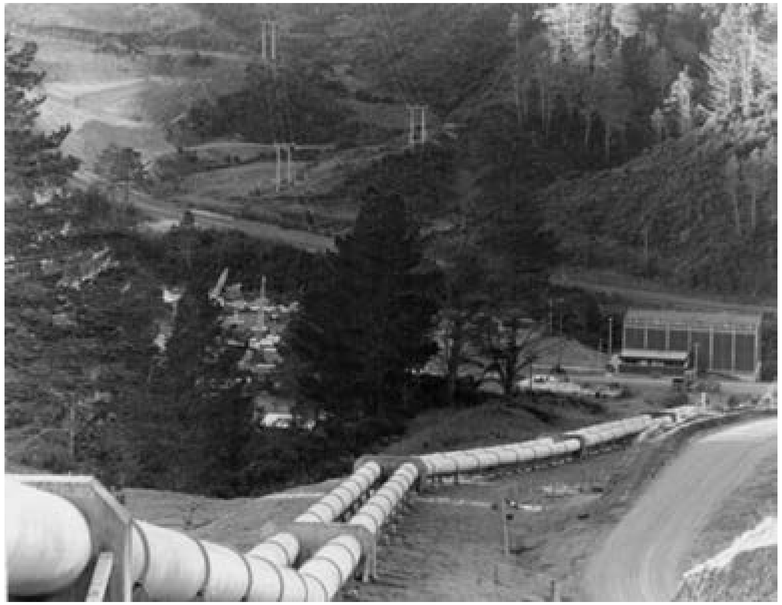
The stadium however was severely damaged by the 2010 Canterbury Earthquake. After reopening, it suffered another devastating earthquake in February 2011 and was torn down in 2012 due to the irreparable damage. The 6.3 magnitude earthquake, which hit Christchurch on February 22, came less than a month after the conclusion of the International Paralympic Committee (IPC) World Athletics Championships. The news of the building's demolition is a huge blow for the region given that the QEII Stadium is one of Christchurch's most iconic sporting venues and that a brand new permanent training track had just been built as part of the requirement for hosting the IPC World Athletics Championships. The Stadium, though, will be best remembered for the race at the 1974 Commonwealth Games when Tanzania's Filbert Bayi (pictured below right) beat New Zealand's John Walker to win the 1500 metres in 3mm 32.16sec, a world record that stood for more than five years.

Source: NZ Engineering 1977, www.insidethegames.biz.

Top: The Commonwealth Games Christchurch 1974
Bottom: Filbert Bayi winning against John Walker, 1974.

1977 – Lloyd Mandeno Hydro Electric Scheme

by Mandeno, Chitty & Bell



Above: Water is drawn from eight rivers and streams, carried via pipes to the power house.
Source: www.delahyde.com/tauranga

This scheme, completed on December 23rd, 1976, was conceived by the late Lloyd Mandeno (1888-1973) over a very long period. As far back as 1925, when Mr Mandeno, as City Engineer, Tauranga was responsible for building the McLaren Falls power station on the Wairoa River, he was exploring the headwaters which fed that scheme. Later, as a consulting engineer, he kept returning to the area exploring various alternatives until the final preliminary plan was produced in May 1963.

The Tauranga joint generation committee, formed in 1965 to build a scheme for the generation of electric power on behalf of both the Tauranga City Council and the Tauranga Electric Power Board, fostered three power schemes, one of which was Mangapapa (now known as Lloyd Mandeno).

The scheme takes water from eight rivers and streams via seven intake structures, carrying it by 7,700m of tunnel, 2,400m of canal, 1,603m of conduit and penstocks to the Lloyd Mandeno power house where two generators, each of 7.5MW, produce 80,000,000kWh/yr.

The judges for the competition were impressed with the overall concept of the scheme of collecting water from several watersheds to fully utilise the available fall of the river in a series of lined stations.

The consulting engineers' work in tunnelling and their obvious care for the environment were other significant features.

A feature of the scheme which captivated the interest of everyone in the district was the manner in which water was diverted from all available sources to the power station.

The intention was that all tunnels would be made by a tunnel-boring machine, and, in the main, left unlined. The alignments of the tunnels were therefore chosen so that the machine would pass through suitable material.

During tunneling, a wide variety of materials were encountered, necessitating the procuring of a second tunnel-boring machine capable of handling hard rock, realignment of some sections, withdrawal of the machines to allow hand-mining, and a greater length of lining than had been anticipated.

Particular attention was paid to the design of the various intakes and model testing produced the self-cleaning top-entry intakes used.

Other noteworthy features of the scheme include:
Level controller – A float-operated radial gate of original design was installed at the outlet of the last tunnel, automatically controlling the water level in the canal by shutting off the flow when generators close down, and opening to maintain level when the generators start up.

Pressure relief valves – Because surge tanks would have been impracticable, pressure relief valves were used on each turbine. On sudden reductions of load, water flow is diverted from the turbine concerned through the relief valve which discharges through an energy destroyer.

Pelton wheel – The use of cooling water in the power station at the full head available from penstocks would have been wasteful. A Pelton wheel turbine, driving a 30kW induction generator, was therefore installed some distance up the penstock line, its discharge providing the necessary water at a much lower head.

Power house – The power house is a reinforced concrete structure clad with precast concrete panels. The two vertical turbines are each of 8,110kW and run at 750 rev/min, driving two generators each of 7,500kW capacity at 0.8 power factor.

The performance of the turbines and generators and the main hydraulic data is monitored by a supervisory system which transmits the data by V.H.F. radio to a remote control room in Tauranga.

Source: NZ Engineering 1978

Lloyd Mandeno was born on 3 October 1888 at Rangiaowhia, near Te Awamutu. His involvement with electric-power generation began in 1910–11 with the installation of the first alternating-current plant in Auckland, a 6,600-volt link between tramways. His knowledge was further extended by working at the Horahora hydroelectric station, built by the Waihi Gold-Mining Company. A passionate advocate of hydroelectricity, Mandeno worked for the Tauranga Borough Council from 1915 to 1926, promoting the use of electricity from the Omanawa Falls power station. A local gasworks had been set up in 1909, and he had to combat residents' reluctance to change to another unknown method of cooking. He set up a shop in Devonport Road as a demonstration room, generating electricity with a dynamo driven by an oil engine; within a year 100 installations had been made. He then persuaded R. S. Ready to build a new home without a chimney, relying solely on electricity. To provide hot water he designed a galvanised-iron cylinder, insulated with six inches of pumice, with a 350-watt heating element. It was possibly the world's first electric storage heater, and the house was said to have been the first in the world dependent on a public power supply for all its energy requirements. In the early 1920s Mandeno wrote a paper on electricity demand in Tauranga, especially that used for cooking. At the time the town was the most advanced consumer of electricity for domestic purposes in New Zealand: there were no electric ranges in service in Auckland, and few in Christchurch and Dunedin, whereas 10 per cent of Tauranga residents were using them. Mandeno later improved on the original water heater, using copper to prevent corrosion and developing a quick recovery system for heating water after heavy use. He patented the idea, but lacked the business skills to profit financially.

Mandeno was responsible for many innovations: he developed portable moulds to cast concrete poles on site, experimented with prefabricated steel poles in 1921, and used New Zealand's first pole-erecting machine at Kaikohe. He laid a submarine cable – one of the first of any length in the country – to Zane Grey's fishing camp on Urupukapuka Island in the Bay of Islands, and set up the first electrically powered sawmill and milking shed in the North Island. He also provided power for Chateau Tongariro and chair-lifts to ski fields, and developed a high-pressure hot-water system for Auckland and Tauranga hospitals. The Kuratau hydro station near Lake Taupo, which opened in 1962, exemplified his inventiveness and tenacity. When a rocky gorge proved unstable he designed a new rock-fill dam, and in a race against the waters of the rapidly filling hydroelectric lake, supervised its construction himself when contractors refused to tender. At the end of his career he had nine hydro stations to his credit, including the Lloyd Mandeno Power Station in the Kaimai Range.

Source: www.teara.govt.nz

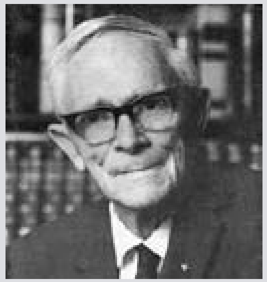


Photo: Lloyd Mandeno

1978 – Whitiora Bridge, Hamilton

by Murray-North Partners Limited

Whitiora Bridge, also known as the Boundary Road Bridge, opened in 1978 to ease traffic congestion in the city centre. The designer was complimented for the blend of practical engineering with aesthetic design. The structure represented a high standard of concept, design and construction with tremendous visual appeal.

Constructed by Rope Construction Limited between 1975 and 1978, it was the city's fifth bridge across the Waikato River. It was constructed at a 25 degree skew to the river, which aligned with a new section of road from the Mill Street/Ulster Street intersection to Boundary Road. It had two traffic lanes, cycle tracks and a footpath. It now has three traffic lanes and a footpath. The bridge is a five span prestressed concrete box girder bridge on high octagonal piers. It is 260m long and cost $2.3 million to build. It was opened on 11 February 1978 by Maori Queen Dame Te Atairangikaahu, Works Minister Venn Young and Mayor Ross Jansen.

The design brief, prepared by the Hamilton City Council in 1972, fixed the horizontal and vertical alignment of the bridge and required the consultants to provide for eventual duplication of four traffic lanes and to place high importance on the aesthetics of the structure, if necessary at some cost.

The designed was required to make a high-level crossing of a well-defined river valley with established public reserves on both banks.

The skewed alignment, placed to minimise damage to the trees, determined the practical length of the bridge. The considerable cost involved in obtaining founding in the deep alluvial sand and silt deposits, together with the height of the bridge, had a major influence on the bridge's configuration.

The recommend proposal was for five spans with box girder superstructure throughout.

At 260m, the structure is long enough for elastic and creep shortening shrinkage and temperature movements to be appreciable.

Although the piers are tall they had to be proportioned to resist seismic forces. If a continuous superstructure had been adopted, large bending movements would have been induced in the piers by the shortening movements and when combined with other bending movements would constitute a difficult design. The magnitude would be variable and could cause plastic hinging at varying levels of seismic attack. These problems were overcome by introducing sliding hinge joints into the penultimate spans. Pier top displacement from superstructure shortening and restraint against differential temperature, with their induced movements, were also greatly reduced.

The introduction of hydraulic shock transmission units across the expansion joints ensures that the three sections of the bridge will not act as independent structures during longitudinal seismic attack.

The beam haunching, while structurally derived, enhances the appearance by making the superstructure slender and elegant as it springs lightly from bank to bank touching rhythmatically on the four piers on the way. This effect was assisted by making the piers appear slender from all view-points. The was achieved not only with the shaping but by making them slightly narrower than the soffit of the box girder.

Source: NZ Engineering 1979; Hamilton City Libraries – Hamilton Heritage

1979 – Karioi Thermo-Mechanical Pulp Mill

by William Hodge

Owned and operated by Winstone Samsung Industries Ltd, the Karioi thermo-mechanical pulp mill is the first of its type in the country. It produces 68,000 tonnes of newsprint-grade paper pulp for export. Of this 70 per cent goes to the Republic of Korea. A well-conceived development providing an efficient manufacturing plant with maximum utilisation of waste materials to conserve energy. An outstanding factor in the successful outcome of the project management skills displayed by the Principal Adviser in the major pulp mill, a project which is making a significant contribution to export earnings.

Mr Hodge was the principal consultant responsible for the design, construction and overseeing of one year's operation at the mill. He has been in private practice as a forest industry consultant since 1974 and since then has been engaged exclusively in the timber, pulp and paper industries, site selection, operations management and product marketing.

Under Mr Hodge's control the $30 million project, built by Downer and Company Ltd of Wellington, was finished in less than the scheduled time in the remote Karioi location and met its budgeted cost. The mill is designed to fit its rural location.

The pulp mill construction commenced in January 1977 with the first pulp dispatch in November 1978. The Mill produces wood pulp that is used mainly for newsprint or paperboard manufacture. The production capacity of the Mill has more than doubled since it opened. New plant, processes and technology were introduced to improve product quality to better meet customer requirements, enabling the company to expand to the Pacific and Asia including countries such as China, Vietnam, Korea, Taiwan, Indonesia, Japan and Australia.

Source: NZ Engineering 1980 and www.wpi-international.co.nz

1980 – Air NZ No 1 Hangar

by Beca Carter Hollings & Ferner

An outstanding engineering project which involved an unusually wide range of technical, design and project management skills. The Consultant provided full design of civil, structural and building services together with full quantity surveying, construction supervision and administration, project management and planning services. The projects involved maintenance hangars for F27 and B737 aircraft at Christchurch.

The Consultant was commissioned in 1974 by the National Airways Corporation of New Zealand (now part of Air New Zealand) to carry out the total design, supervision and project management of the new maintenance hangar in Christchurch. This project was completed in 1978 and involved a number of innovative design features, including a 122m clear span prestressed concrete box girder and a chimney on seismically "rocking foundations" and measures within the hangar to confine damage in the advent of aircraft fire or severe earthquake to ensure it can remain operational. The roof structure comprised 61m span steel trusses at 12.6m centres and incorporated both medium and high grade notch ductile steels.

This project included the following components:

- Hangar of 122m x 61m clear area x 20m height
- Hangar annex of 122m x 30m including workshops
- Central plant building, with chimney, fire storage reservoirs and underground services tunnel
- Hardstand formation, roading, carpark and landscaping.

Foundations for the concrete girder each comprised a single pour of 1,200m^3 of concrete. The Consultant performed studies of the effect of the temperature gradient caused by cement hydration and the effect it might have on the final structural behaviour of the foundation. This study included theoretical predictions of the temperature gradient using a computer technique recently developed then by the University of Canterbury and from these temperature gradients, the flexural stresses were calculated. Predictions of temperature, which were subsequently monitored on site and found to be accurate, led to a more rational design of reinforcing and the development of sound design, placing and curing techniques. (Thermally induced rotation of these foundations would have had a significant effect on the behaviour of the concrete girder which they support).

Analytical techniques employed by the Consultant resulted in considerable cost savings to the client for the hardstanding and access way pavements associated with this project. Approximately 15,000m^2 of pavement was involved. Conventional design procedures indicated a substantial thickness of asphaltic concrete would be required to support loads from medium to heavy aircraft.

The adopted design method enabled the strength of the underlying alluvial gravel to be fully incorporated into the pavement analysis and demonstrated that the thickness of asphaltic concrete determined by other methods could be halved without sacrificing durability and service life.

The difficult technical issues in concept and analysis required innovative and pioneering approaches. Within existing constraints the project achieved a high degree of aesthetic satisfaction coupled with an economic design. Early completion was achieved by letting the work out as several separate contracts, monitored against pre-determined programmes and budgets.

Above: 122 metre clear span prestressed concrete box girder

1981 – Marsden B Offshore Cooling Water System

by Morris & Wilson

Top: February 1976, works proceeding of Marsden B with the chimney of Marsden A in the background.
Bottom: Laying the underwater pipes.

When commissioned in 1968, Marsden A power station (240 MW), situated near the oil refinery at Whangarei, was New Zealand's first major oil-fired power station and the third largest of any type in the country. When the station was designed, provision was made for duplication of its capacity in future years if required. The new plant, scheduled for completion in 1978, is known as Marsden B.

When New Zealand Electricity decided in 1975 to construct a new 250 MW thermal power station R W Morris and Associates Consulting Engineers Limited was engaged by Bechtel Pacific Corporation Limited to design and supervise the construction of the cooling water system.

The cooling water system consisted of two 2.5m diameter concrete pipelines (one intake and one outlet) extending some 550m and 850m respectively into the ocean off the Northland coastline. The majority of the pipes were made in 10m lengths by epoxy/dowel splicing, two vertically cast, 5m long concrete sections. Joints between pipes were spigot and socket with a rubber "O" ring and the pipes were laid using a purpose built underwater pipe layer. Both pipelines were buried throughout their length and terminal structures were designed to be wholly constructed on land before towing to the site for installation.

All joints, pipe bearings and laying procedures were inspected underwater by R W Morris and Associates Consulting Engineers Limited own engineer/divers. Similarly, since completion the interiors of both pipelines have been regularly inspected for signs of pipe movement, and/or joint leaking by R W Morris and Associates Consulting Engineers Limited engineers.

However, the sudden unexpected and rapid rise in the price of oil in the 1970's, and a less than forecast demand for power, led to the mothballing Marsden B before it was completed in 1979. Marsden A power station is now owned and operated by Mighty River Power.

Source: http://ocel.co.nz

1982 – Aniwhenua Hydroelectric Project

by Tonkin & Taylor / Leyland Watson & Noble

Above: Rangitaiki River meeting Lake Aniwhenua

The 25MW Aniwhenua hydroelectric scheme in the eastern Bay of Plenty was commissioned in 1980 within 3 years of construction being commenced. The scheme incorporates a 2.2 km long headrace canal and two dams of moderate height, and is built in an area of ignimbrite rock and air fall volcanic ashes. Equipment includes radial and flap type flood gates, wheeled penstock intake closure gates and twin vertical shaft Francis turbines.

A challenging project that required a large range of technical skills in a number of engineering disciplines. Of particular note is the determination of the designers to use materials indigenous to the locality and the consequent depth of investigation carried out to determine the suitability of the variety of soil types within the area for use in constructing two dams and a 2.2km canal. The use of filter cloth in both the dam and barrange embankments in conjunction with local soils was at the time of design a new technique.

Particular care has been taken with environmental aspects. The project enables the public to enjoy a much improved access to the Aniwhenua Falls as well as providing a lake of over 250 hectares for recreational pursuits. The curves of the canal blending with the surrounding country and the powerhouse sited just downstream of the falls demonstrate the designer's sensitivity to the existing natural features.

Effort and care were spent in soil type investigation and testing, the provision of seepage monitoring devices and the new technique of using filter cloths, both in the dam and barrange embankments.

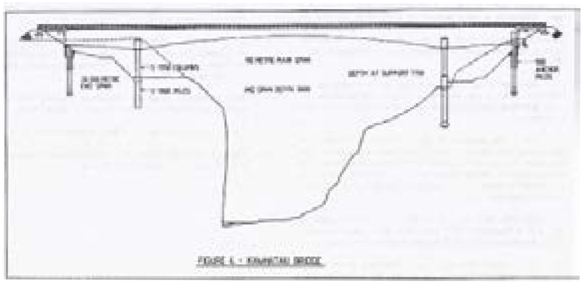
The project demonstrates a high standard of skill in the selection and the design of the plant which is easily accessible for maintenance, operates automatically under remote control and provides the total domestic electricity requirement of the power board. "Failsafe" facilities have been incorporated into the works to provide protection against damage by major floods.

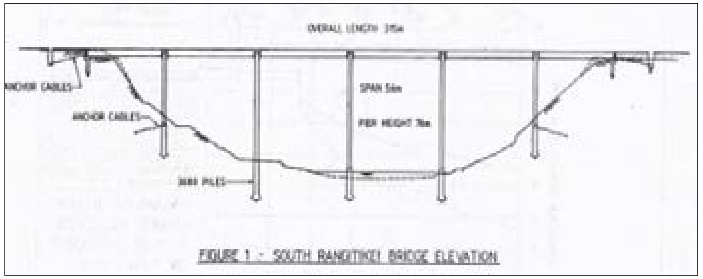
The Aniwhenua project had earlier been responsible for two other awards. The New Zealand Contractors' Federation selected it for its 1981 Construction Award and the International Federation of Asian and Western Pacific Contractors' Association also awarded the contractors, Downer and Company Ltd, its Gold Medal for outstanding civil engineering performance.
Source: http://waimaori.maori.nz.

1983 – Mangaweka To Utiku Rail Deviation Bridges

by Beca Carter Hollings & Ferner

Left: North Rangitikei Railway Bridge, **Right:** Train on the spectacular South Rangitikei Bridge which is 315 metres long and 80 metres above the River.





Above Left: Kawhatau Bridge, **Above Right:** South Rangitikei Bridge

The North Island Main Trunk railway between Mangaweka and Utiku originally followed a tortuous route along narrow benches some 100m above the Rangitikei River in the Central North Island. Steep gradients, tight curves and narrow tunnels made it a difficult and costly piece of line to operate and maintain in this geologically unstable and seismically active region. Therefore, New Zealand Railways (NZR) decided to re-route rather than upgrade this stretch of line. Contracts for the bridges were let in 1972 and the deviation was opened to traffic in November 1981.

This award is made for three prestressed concrete bridges. The South Rangitikei Bridge, one of the largest concrete rail bridges in the world, is a continuous prestressed concrete box grider. North Rangitikei and Kawhatau bridges are identical; and are the longest span concrete structures in New Zealand.

A major design requirement for these structures, and their foundations, was adequate resistance to earthquake in this seismically active region. The South Rangitikei bridge employs, for the first time, in any structure, a "stepping pier" design whereby in an intense earthquake the piers may lift off their bases, either side alternately by up to 125mm. The motion is damped by "energy dissipators", developed by the Department of Scientific and Industrial Research, mounted within the piers.

The bridges were designed and built with a careful sympathy for the environment. They have an elegance and simplicity of form which belies their scale and makes them visually very acceptable within the landscape. The piers of the South Rangitikei bridge rise cleanly from the valley floor, and have a minimum effect on the river and the vegetation. The other bridges clear the valleys completely. The designs and construction methods for all three bridges required only minimal intrusion into the river valleys during building.

The construction of the South Rangitikei bridge was marred by a failure of the girder carrying the formwork, under the load of a concreting operation. The judges considered however that this incident did not detract from the quality of the design of the bridge itself.

Bold in concept, sophisticated in design yet modest in form, these bridges, major structures by international standards, must be considered an outstanding engineering achievement.

Earthquake Resistance

Designed by Beca, Carter, Hollings and Ferner and built by the Italian company, Codelfa Construction, the South Rangitikei bridge has an earthquake resistant feature uniqie in New Zealand and rare in the world.

Earthquake resistance for the bridge is provided by allowing a rocking action to occur with each leg of the pier designed to actually lift off its foundation base alternately from side to side. In order to control the "rocking" of stepping action, energy dissipators developed by the Department of Scientific and Industrial Research have been installed in the pier bases.

Work started on the bridge in April 1973 with the construction of the piers.

On completion of the piers, work started on the spans. A launching girder, built especially for the job by the contractor, was sent out from the bank to the first pier and then travelling formwork was moved along the length of the girder as the concrete was poured to build up the concrete spans.

Girder collapsed

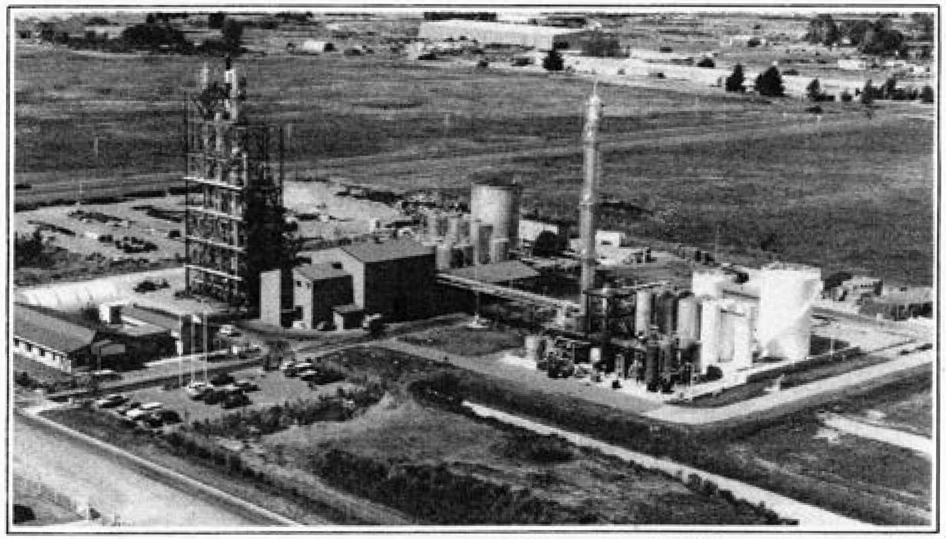
Work had finished on the first 45.5m span and had started on the first of the four 56m spans when in May 1975, the launching girder collapsed and sent 200 tonnes of material in the river.

This accident caused all work to sop and it was not until September 1979, when a new launching girder had been built, that work restarted.

However once work got going again progress was quick and the bridge was finished by August 1981.

Source: NZ Engineering 1982, IPENZ – Engineering Heritage

1984 – Tall Oil & Turpentine Distillation Plant, Mt Manganui *by KRTA Ltd*



This project was made for the Pine Chemicals NZ Limited and it's the only one of its kind in New Zealand. It processes by-products of the pulp and paper industry which previously were sent overseas and later re-imported.

Tall oil, is a by-product of the pulp and paper industry. It is produced on two sites: crude tall oil is extracted by kraft wood pulping mills, and then this crude is processed off-site. Until 1983 it was sent overseas, mostly to Japan, for processing. In 1980 work began on a plant in New Zealand to process this oil, and in 1983 Pine Chemicals Ltd. (which also process turpentine) began operation. All New Zealand and a small quantity of Australian crude tall oil is now processed in Mt. Maunganui by this company - now known as Eka Chemicals (NZ) Ltd.

The Consultants provided an independent engineering service to Group Engineering and were required to provide an architectural, site layout, planning and engineering design service to coordinate the finished process technology into a complete processing plant. This included civil, structural, mechanical, electrical and some process engineering design.

The close coordination and integration of design from foundation sub-grade to the top of the process towers demonstrates an optimising of the design of the plant to meet site, seismic process and other requirements while at the same time serving to minimise the overall cost of the project. Also it has produced a plant which will have a high degree of relibility under all conditions.

This project is an example of New Zealand industry buying overseas process plant packages and then making maximum use of New Zealand resources to plan, complete the design and integrate the whole installation. It could also serve as an example to developers of other major projects.

Planning for statutory and safety requirements was basic, imaginative and effective and demonstrates what can be done when all these are dealt with as a specific operation at the start of the project. Completion of the project to time and budget reflects the level of performance of the consultants and their clients.

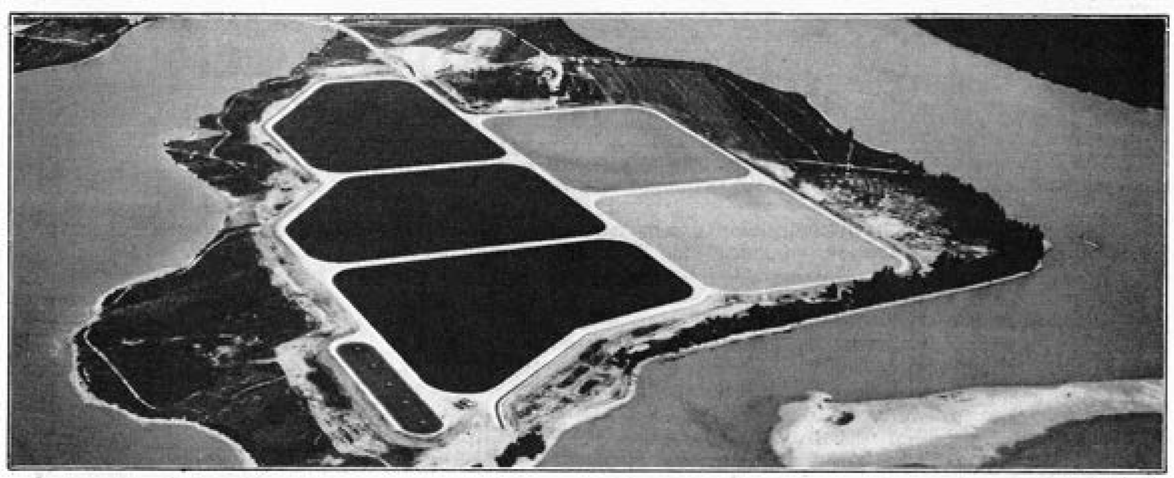
The imaginative approach to structural and mechanical design and the coordination of all design and planning to the maximum advantage of the project must be considered an outstanding contribution to the profession of engineering.

Source: ACENZ archives.

1985 –Nelson Regional Sewage Scheme

by Beca Carter Hollings & Ferner

The scheme serves three local authorities as it was designed to collect and treat wastes from the Stoke Tahunanui area of the city of Nelson, Richmond Borough and three industries within Waimea Conty – the Apple and Pear Board's juice factory, Waitaki NZR meat works and Nelson Pine Forests Ltd's wood chip mill. The need for the scheme became evident in the early 1970s when it became obvious that the Waimea Estuary was being affected by the wastes discharged into it.



Above: The picture shows the oxidation ponds on Bells Island in the Waimea Estuary, part of the Nelson Regional Sewerage Scheme.

The development comprises foreshore collector sewers, three main pumping stations, treatment facilities and an outfall into the Waimea estuary. The Consultants provided a full primary engineering service to the client, including conceptual planning, design, construction supervision, advice on cost sharing and overall project management.

The nature of the area which includes recreational beaches and enclosed waters, estuarine flats and marshes of value as a fish nursery and to bird life, presented a challenge to the engineers to overcome the ecological deterioration and public health hazards in an effective, unobtrusive and financially acceptable manner. The adopted scheme meets the objectives and indeed is operating to standards which exceed the water rights requirements.

The features of planning and designing which endow this project with distinction include:

- The choice of outfall location in combination with unobtrusive treatment plant sitting on Bell Island to achieve an excellent balance between the cost of collecting sewers and treatment and the assurance of adequate dispersion of the treated effluent.
- The ability to receive and stabilise (without pre-treatment) industrial wastes of variable flow and strength.
- The careful attention to all aspects of investigation, evaluation and design of the component parts of the system to achieve high efficiences and maximum use of local materials.
- A comparatively low capital and annual operating cost.

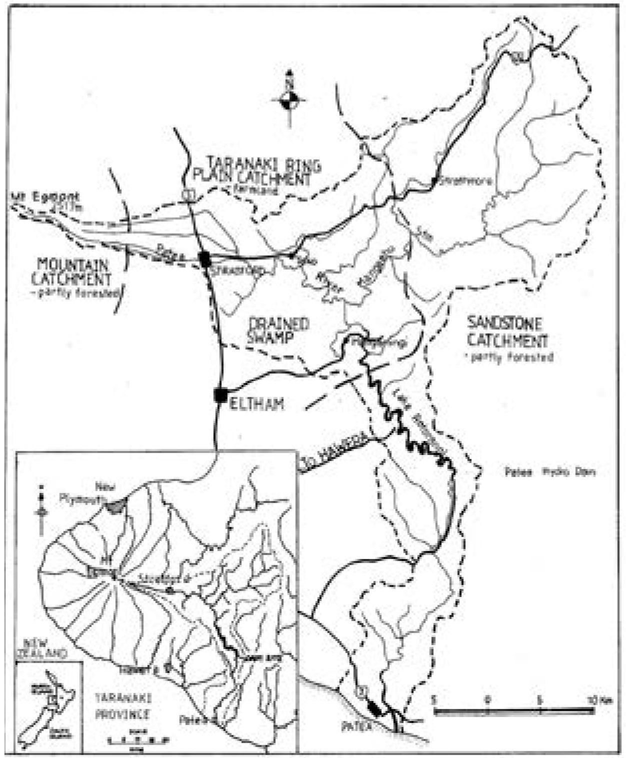
The task of bringing the design into effect was handled exceptionally well by the Consultants. This included assisting the client with marketing the scheme to six separate interests, comprising three local authorities and three principal industries. Separate contracts were let, co-ordinated and administered for various components of the project, which was completed on schedule and within budget.

Overall, it is noted that a wide variety of possibilities existed for meeting the needs of the situation. It was the diligent attention of the Consultants to narrowing down the options to the one which meets the performance requirement as well as community aspirations as to annual cost and environmental impact, which has qualified the Nelson Regional Seweage Scheme for the 1985 ACENZ Gold Award of Excellence.

Source: ACENZ archives.

1986 – Patea Hydro electric Power Scheme, Civil Works

by Beca Carter Hollings & Ferner (Ron Carter and Dr D V Toan)



Commissioned by the Egmont Power Board, the project involved all facets of planning, design and design supervision of the 30 megawatt power scheme on the Patea River. Development of the scheme took almost 10 years from the decision by the power board to start investigations to the date of first power production. The scheme has also produced NZ's longest man-made lake.

The Patea Hydro Electric Scheme was the first of the local authority hydro electric schemes to be subjected to full environmental scrutiny. Many environmental planning techniques which are now standard practice were developed during the approval processes for the Patea Scheme.

In the 1970's the world economy was severely affected by disruption in oil supply from middle east states. A potential world energy crisis was seen which would affect New Zealand badly. A Government policy was formulated encouraging local authority Electric Power Boards to develop hydro resources within their area. Favourable Government finance was offered. Local energy resources were examined, including environmentally sensitive rivers. The Patea River was chosen as having the potential to supply a large proportion of the Board's electricity demand.

The chosen scheme had a dam in a remote section of the Patea River 42km upstream from the mouth. The dam would raise the water level by 60m creating a narrow sinuous lake which extended 47km back through remote bush covered gorges. The power station output of 30MW would generate directly into the Egmont Electric Power Board supply network. The drawing below shows the dam location and catchment area.

Construction problems

Construction in the tertiary sandstones/siltstones has its own particular problems in the wet west coast climate. The construction season for earthworks was confined to summer only and as little as 2mm of rain was sufficient to stop fill placing. Dam construction was delayed initially when an unexpectedly large number of massive limstone blocks were found in the river bed below the original river level.

These caused delays to the project and increased costs. Methods of accelerating construction were devised to bring the project back on schedule, but the "southern oscillation" with its wet summer on the west coast in 1982/1983 gave 20 percent less working days than average. The dam was not finished until the 1983 spring, causing further delays. The delays in earthworks also delayed placement of over 20,000m3 of concrete for the concrete structures. Acceleration incentive payments were calculated to give the contractor a proper return for his additional investment in plant and labour and operating costs to speed up construction. This extra effort succeeded in bringing the project to an income-earning stage earlier than otherwise would have been possible.

Lake Rorotangi

Fringe benefits of the Patea Scheme are improved access in the lower Patea Valley and the river backs up on the very flat gradient of the Patea River. This lake is to be known as Lake Rorotangi, and is now the longest man-made lake in New Zealand. Taranaki is deficient in calm water recreation areas, and the lake will be well used by fishermen, canoeists, and water skiers. The entire shoreline has been cleared for vegetation to allow this use. Parts of the lake resemble a fiord with high bush clad slopes dropping steeply into narrow reaches of dark green highly reflective water. Further upstream the lake is confined to its narrow valley between fertile terraces of Taranaki farmland.

The chosen name of *"Rotorangi"* is taken from the adjacent block of Maori land. The translation can be interpreted as *"Chief Lake"* – very appropriate for this lake in the Taranaki scene.

Source: www.riley.co.nz, NZ Engineering 1984.

1987 – Canterbury Accelerated Pavement Test

by Ian Wood & Associates

The machine (pictured right) was designed for the accelerated testing and evaluation of road formations, substrates and surfacings by replicating, with near precision, the effect on the pavement of actual road traffic conditions.

The facility consists of two diametrically opposed radial arms which rotate about a fixed centre. Different bogies can be attached to the outer ends of the arms, each equipped with a particular wheel and axle combination. The design initially provides for three bogey types giving single axle single wheel, single axle dual wheel and tandem axle dual wheel arrangements.

To facilitate track relaying, mid length hinge joints in the arms are released and the bogies motored off the track onto the central area. The centre height of the pedestal can be adjusted by +100/-50mm to compensate for differing pavement heights.

Wheel loadings are varied from the practical minimum up to the maximum legal limit for each combination by the attachment of steel weights. Standard commercially available wheel sets, axle assemblies and suspensions are used and thus the machine can be reproduce the road wear of vehicles from light commercials through to the heaviest tandem axle trucks in common use. Initially, the machine is equipped with single axle dual tyred wheels with provision for wheel loadings between 2130 to 4690kg. Road speed is variable in increments of 1kph up to a design maximum of 50kph.

The prime objective is to produce definitive rather than comparative results in pavement performance which can be applied directly to highway design, so optimising the cost effectiveness of highway construction.

Source: Engineering News 1987

Above: Tester and track.

The development of the Canterbury Accelerated Pavement Test Facility by Ian Wood Associates demonstrates an extremely high degree of understanding of the client's requirements transformed into a very sophisticated facility capable of applying a myriad of pavement loading conditions via an excellent example of a successful marriage of electrical, mechanical, electronic and hydraulic systems, much of which was developed from first principles.

1989 – Tui Industries-Vented Tube Heat Recovery Heat Exchanger *by Bruce Henderson Consultants Ltd*

The California-based client's need was to meet new USA legislation requirements for heat exchanger which would use waste heat from ammonia refridgeration plant to heat potable water. The key requirement was to prevent accidental leakage of ammonia into the water.

Top: Low-stage heat exchanger is mounted in the overhead. Entering at 140°F, the ammonia vapor from the booster compressors heats potable water and exits to the intercooler at 94°F.

Bottom: Vapour from the high-stage compressors passes through this parallel set of heat exchangers on its way to the condensers. Temperature of the preheated water from the booster heat exchanger is raise d to 117°F before being stored in a 20,000 gal tank.

Rather than employ two heat exchangers, with the inefficiencies inherent in using an intermediate transfer fluid, the concept adopted was to use a double skin heat exchange surface with a ventilated gap between the two skins to enable any leaks that occurred to be readily detected; a simple concept to grasp but one for which an economical engineering design solution had not previously been found.

In a process which overall took several years of painstaking work, the Consultant designed and developed a multi-wall vented tube, suitable for incorporation in a heat exchanger, and with a performance approaching 95% of a single wall tube.

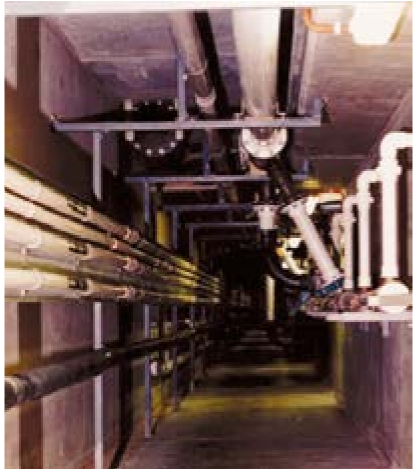
The next and most difficult step was to design and develop the technology to manufacture such a multi-wall vented tube. Finally, the design of the heat exchanger, suitable for mass production and incorporating the vented tube, involved development of a five-pass counterflow arrangement and purpose made seals manufactured from a novel material capable of handling the complex thermal expansion forces. Prototypes were manufactured in New Zealand and tested to establish feasibility.

The project as a whole demonstrated the skills and expertise of the Consultant, working with the tool maker and heat exchanger manufacturer, in solving the problem in a unique way. For the manufacturer, the project represented a major investment which hinged largely on the Consultant's ability to produce an economical solution.

Source: ACENZ archives.

1989 – Wellington Regional Aquatic Centre

by Beca Carter Hollings & Ferner Ltd



"The design shows considerable attention to detail in all its aspects and it has fully met the client's expectations for a versatile and comfortable environment for both users and operators"

Left: Main pool. **Centre:** Main pool service tunnel and return air plenum**, Right**: Main pool plants room.

The objective of the client, the Wellington City Council, was to provide a regional facility, sufficiently versatile not only to meet the requirements of international level swimming and diving competitions, but also to accommodate the full range of aquatic based sports and recreational activities. The Aquatic Centre has a 50m x 25m main pool for swimming and diving and a smaller 25m x 8m warmup/learner's pool, together with toddlers' pool, saunas and spa tools, meeting rooms, spectator seating for 1,200 persons, landscaping, car parking, offices and other amenities.

Beca Carter Hollings & Ferner were the principal Consultants for the project and were responsible for preparation of the brief, overall project management and cost control, foundation investigation, structural design, and co-ordination of building services and water treatment design.

Some noteworthy features include:

The Aquatic Centre design – the use of ozone disinfection of the pool water, combined with diatomaceous earth filters provides a reliable high quality water.

Foundation Conditions – the building is located on fill that was placed on the original shore line at the turn of the century. The optimum foundation solution derived from the study of several combinations of raft/spread/pile foundation systems which consists of bored insitu piles for the concentrated building column loads, and raft foundations for the pool structures demanded precise determination of differential settlements.

Ground Water Level – Because of the close proximity to Evans Bay, the ground water levels are not only high, but fluctuate with the tidal movements. The design solution provides a sub surface drainage system to equalise the ground water level around the building with tension piles beneath the diving pool, and on 800mm raft foundation slab beneath the main pool.

The completed pool is a clear demonstration of the high level of expertise of the Consultants and the design team which they headed, in the design of this complex building type. The Centre is designed for versatility and efficiency in operation – the main pool features a boom system which enables three different activities to take place simultaneously and the surrounding service tunnel provides viewing and acting as a return air duct. The structure provides access to lighting, ventilation ducts and a permanent TV filming facility, while energy management, lighting control and heat recovery systems are integrated into the overall concept.

Source: ACENZ archives.

1990 – Design and Project Management of Wellington Police Launch “Lady Elizabeth III”

by John Harrhy, Consulting Engineer

Above: Lady Elizabeth III at her berth in Wellington. **Right**: The moment of truth! Lady Elizabeth III pull sherself upright during the full rollover trial at Nelson.

Following the loss of the Lady Elizabeth II, a team of police specialists were sent by the NZ Police to evaluate Search And Rescue (SAR) and Police craft in Europe, SE Asia and North America, however they were unable to come up with a solution that they were happy with. John Harrhy was approached and commissioned to develop a design in consultation with the Wellington Police SAR specialists. The report into the sinking of the Lady Elizabeth II in July 1986 had, as its principal recommendation, that the replacement launch should be self-righting. No other vessel in the world at that time combined the self-righting features developed for lifeboats with that of a Police and Pilot launch.

“Lady Elizabeth III” meets all the requirements of her role as a combined police, pilot and search and rescue vessel in the testing conditions of the vicinity of the Port of Wellington. She is a fast, seaworthy and reliable vessel, unique in providing an ability to self-right through 180 degrees of heel.

Her construction is of fibre reinforced plastics and, in understaking this project, the Consultant integrated the surface definition capability of existing computer programmes with his own mathematical computer models of hull panel and stiffener moduli enabling the transfer of masses and centres to a mass control programme without further manual entry. In achieving this, the Consultant made use of the advances made by others in the America’s Cup campaigns but developed his own technology to achieve the rigid control of centres of gravity which were essential to the success of this project.

The Consultant’s design also included another feature insisted upon by the police, waterline access at the stern. This not only made it more difficult to achieve the self-righting capability, it posed the additional problem of potential “pitch-poling” – where the craft sinks either by the bow or stern.

The most demanding trial for Lady Elizabeth III is the proof of her ability to self-right unassisted from a full 180 degree roll. In order to ensure the self righting capability of the vessel, the Consultant used the existing stability software in addition to both computer and physical models which he made himself. The study was critical in both the transverse and longitudinal roll axes. The Consultant was responsible for all structural calculations, and all other decisions relating to the project.

The Consultant managed all aspects of the project. Monthly and total cost constraints applied and were controlled by attention to the tender and contract documents.

Remarkable achievements in the project include a final mass and centre of gravity location to a precision not normally experienced in the marine industry, a completion date on target, a final cost overrun of less than one percent, a self-righting ability demonstrated at the first test in front of the general public and media and, in total, an elegant solution to the needs of the owner.

Source: ACENZ archives.

1991 – Air New Zealand B747 Maintenance Docks

by Beca Carter Hollings & Ferner

Above: First trial fit of fuselage dock

Air New Zealand commissioned Beca Carter Holdings & Ferner to develop a concept for Maintenance Docks capable of affording sumultaneous access to the fuselage and tail sections of Boeing 747 aircraft.

The Consultant provided multi-discipline design services for the complex and exacting undertaking and managed all aspects of the project including design co-ordination, cost planning, contract administration, supervision and development of trial fit and commissioning procedures.

The necessity for maintaining very close tolerances between components of the docks and the curved and moveable surfaces of the aircraft, demanded very accurate determination of dimensions without the benefit of any preliminary trial fits.

Using remote controls, operators can safely set up all components of the docks within about thirty minutes of the aircraft being positioned in the hangar. This represents a remarkable and valuable reduction in the time needed to provide access for maintenance staff.

The fuselage dock, suspended from the roof, affords excellent access to the sides and upper surfaces of the fuselage and unrestricted movement on the floor beneath and around the aircraft.

Costing significantly less and providing far greater facility than proprietary systems, the maintenance docks have proved very satisfactory. In addition to achieving a high degree of utilisation on its own aircraft the docks have given Air New Zealand the competitive advantage in building for major B747 maintenance contracts with overseas airlines.

Source: ACENZ archives.

1992 – Visitor Facilities Development at Milford Sound

by Duffill Watts & King Ltd, Invercargill

Each decade since the road to Milford was opened to tourists in 1954, the number of tourists had doubled. The wharf buildings were inadequate, with no ticketing or information facilities – only a tiny sheltered area – and one male and two female toilets for up to 1500 tourists per day. The harbour had berths for only six launches and manoeuvring these in the confined space was difficult. The new award-winning tourist launch harbour, four times bigger than the old, has been welcomed by Milford Sound's launch skippers.

Duffil Watts & Kings Ltd was responsible for obtaining all of the approvals and consents for the project designed, detailed and observed construction of all of the structural and civil works including a dredging and reclamation operation, co-ordinated the secondary Consultants and reported to the project cost control adviser. The design and construction was undertaken with considerable sensitivity to and protection of the unique environment under most difficult and demanding conditions.

Main features of the $12m development project are:

- A cutter suction dredge was used to remove 32,000m^3 of sand and gravel from the launch harbour and entrance channel, making the harbour four times bigger.
- The dredged material was pumped into walled-off areas of the foreshore which became the reclamations on which new vehicle parks were formed, creating space for 88 buses and 142 cars.
- Four new floating wharves and a service wharf were built in the enlarged harbour, which now caters for 10 large launches.
- A promenade with room for more than 1,000 people was built beside the wharves.
- The narrow road from the hotel to the wharves was upgraded and widened to Transit New Zealand's standard of 7m.
- Walkways from the airport, hotel and car parks to the harbour were built to separate pedestrians from wharf traffic. The high-use sections of the walkway have been covered.
- Milford's sewerage system was upgraded to strict environmental standards and sand filters were added to clean up the effluent. The outfall was put at a better place and fitted with a diffuser to dilute the effluent when it reached the waters of the fiord.
- A new launch terminal and visitor centre designed by McCulloch Architects, Invercargill, was built on the new harbour. The building has a sheltering roof which lets coaches drop passengers off out of the rain. Inside are ticket offices, large modern toilets, and a main foyer with space for several hundred launch passengers.

The new facilities are eminently functional but perhaps the greatest tribute to those involved with the project is that the recently completed works convey the impression of having been long established.

Source: Southland Times April 21, 1992

1995 – Wairakei 30 MW Turbine IP Casing

by TH Jenkins & Associates Ltd

The Electricity Corporation of New Zealand (ECNZ) elected to refurbish the Wairakei Geothermal Station so as to extend its economic life by 25 to 30 years. Severe steam leak erosion of the intermediate pressure turbine casings necessitated their replacement. ECNZ invited worldwide tenders for the construction of three new wear resistant, heat treated, stainless steel casings.

The contract was won against international competition by a consortium comprising Transtec Engineering Hillside as head contractor, TH Jenkins & Associates Consulting Engineers Ltd as the design engineers and Mace Engineering Ltd as the machining contractor.

As the original engineering drawings were unavailable, the Consultants were required to site measure the worn components to re-establish all dimensions, clearances and tolerances. This critical undertaking was completed on site during one of the short duration 3 yearly machine overhaul periods.

The Consultants provided substantial technical input into the costings, design of the casting, casting process, heat treatment and machining phases of the work. They assisted maintenance of ECNZ quality standards throughout and resolved dimensional conflicts and machining tolerance problems. A finite element analysis enabled several practical modifications to be incorporated into the final design.

The completed casing were delivered to ECNZ on time and with a significant cost advantage over overseas bidders. Two casings have already been installed without difficulty and have produced their original design rated power output for 18 and 6 month periods respectively. The third awaits the next scheduled turbine overhaul.

The project has demonstrated that NZ Engineering Consultants and the Engineering Industry are capable of producing components of a quality, size and accuracy comparable with the best from the workshops in Europe and the United States.

ECNZ is commended for having the confidence to place their refurbishment contract with a New Zealand consortium who were willing to accept the undertaking without the benefit of prior experience.

Source: ACENZ archives.

Top: Bottom half of the casing on the treat treatment hearth at Transtec Engineering Hillside.

Bottom: Breaking out the raw casting on the Foundry floor at Transtec Engineering Hillside.

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