



## GOING THE EXTRA DISTANCE AT THE NEWMARKET VIADUCT REPLACEMENT



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## MESSAGE FROM THE PRESIDENT



Kia Ora readymixers,

It seems that every year the Christmas and New Year period is upon us without warning – and 2012 is no exception.

The past 12-months have been some of the most difficult ever experienced by our industry. The residual effects of the global financial crisis combined with the aftermath of the Canterbury earthquakes to create an incredibly difficult business environment.

Although most economic commentators are predicting 2013 to be challenging, there are signs of recovery, and I am cautiously optimistic that we will experience a better year ahead.

That is not to say 2012 hasn't been a busy year for the NZRMCA. In fact, a range of initiatives came to fruition, including the NZTA's adoption of the fatigue management scheme for concrete truck drivers.

The NZRMCA has also developed closer relationships with the aggregates industry through the Aggregates and Quarry Association (AQA), and we continue to be committed to industry training and education as demonstrated by our presence on the BCITO's National Advisory Group.

The NZRMCA once again supported the New Zealand Concrete Conference. This annual event seems to go from strength-to-strength, and in 2013 we will look to further optimise our involvement. The next issue of this newsletter will highlight the NZRMCA con-current sessions at the 2012 event, as well as cover the remits passed at the AGM.

Several projects from the 2011-12 Business Plan will roll-over into the 2012-13 year, such as the on-going revision of industry Standards, the review of the Plant Audit Scheme, the upgrade of the NZRMCA website and newsletter, and support for CCANZ's *Campaign for Concrete*.

Key to the successful functioning of the NZRMCA Council across all areas of endeavour has been the support and expertise offered by the Technical Committee and Plant Audit Committee.

I also wish to express my gratitude on behalf of Council to Rob Gaimster who stood down as Executive Officer at the October AGM.

Rob's tireless work for the Association over the past 5-years has been instrumental in advancing a host of key concerns. Similarly I would like to thank the recently retired Bary Williams, a long time member of Council, for his astute insight on industry issues.

The meeting attendance, work ethic, professional experience and balanced perspective shown by Council members - Jon Hambling (Immediate Past President), Maurie Hooper, Scott Williams, Mike Botherway, Jason Savage, John Stewart and Brian Godfrey (Regional Chairs), Bob Officer, Andrew Moss, and David Barnard (Plant Audit Committee Chairman) - must also be applauded, as should the work of our Secretary, Angelique Van Schaik.

On a final note, during 2012 I made an effort to attend as many regional meetings as possible. One observation I made was the huge support and commitment the NZRMCA receives from its Associate Members. The work undertaken by the Regional Secretaries in arranging meeting venues, speakers and site visits has been outstanding. I also believe that Peter Fell Ltd, Sika NZ, Golden Bay Cement and Holcim (New Zealand) Ltd, who were represented at every regional meeting throughout the country, deserve special mention.

I hope you have a merry and safe holiday break, and I look forward to working with you all in 2013.

Jeff Burgess

## AROUND THE REGIONS

### LOWER NORTH ISLAND

By John Stewart

At the meeting held in Palmerston North during September, recipients of the Plant Audit Scheme's annual awards from the Wellington region were recognised for their efforts in achieving 100% compliance.



Plant representatives from the Lower North Island region receive their Plant Audit Scheme award certificates.



## AROUND THE REGIONS CONTINUED

### CENTRAL NORTH ISLAND

By Jason Savage

The Central North Island region held its end of year meeting at the Gate Pa tennis club in Tauranga. Jeff Burgess covered the November 2012 NZRMCA Council meeting, while Adam Leach gave the CCANZ update.

Laurie Porter of Holcim (New Zealand) Limited presented an abbreviated version of his 2012 Concrete Conference paper – *New Zealand Silo: Equipment and Industry Safety Standards*. Laurie has agreed to repeat his presentation across all the NZRMCA regions.

Members and guests then made their way to the Tauranga Racecourse for a pleasant and relaxing afternoon watching the gallops. *Hiace* finished ahead of *Ocean Bound* and *Lost World* to take home Race 8, the prestigious NZRMCA 2100 metres.

The champion mount crossed the finish line roared on by a very partisan contingent of readymixers who pretended to have backed the rank outsider: Fuelled with pride and a little bit of Tui, President Jeff Burgess presented the winner's cheque to owner Murray McKeag. A mission was then undertaken to locate the victorious equine. This may or may not have been successful, we don't know, but here is picture of Jeff with a horse.



Jeff Burgess congratulates Hiace, the winner of Race 8 at the Tauranga Racecourse meeting on 2 November 2012.

### BARY WILLIAMS BIDS ADIEU

After eight years at Golden Bay Cement Bary Williams recently retired from his role as National Sales Manager.

Bary started his career in the electronics industry, where he spent 12 years with Bell Radio Corporation, before moving onto HW Smith and then Email Industries. Bary later entered the building industry when he joined the sales team at Firth Industries, after which he moved to Roberts Cavitec, where he became General Manager.

Prior to joining Golden Bay Cement, Bary worked at Stevenson & Sons for over 17 years, quickly progressing through the company from Sales Manager to General Manager to CEO.

Bary has spent many years as a NZRMCA Council and CCANZ Board member, during which time his take on industry issues and personable manner made him a key contributor to advancing concrete interests.

The NZRMCA wishes Bary, and his wife Carol, all the best for a relaxing future, and look forward to seeing him at either Auckland or Northland regional meetings should he wish to pop in and say hello.



Bary Williams

### SOUTH ISLAND MEETING

By Brian Godfrey

Held during late November the most recent South Island region meeting took place in sunny Nelson at the Trailways Hotel. Adam Leach and Laurie Porter gave their respective presentations to the well attended gathering, while Steve Williams of the NZ Drug Detection Agency (NZDDA) outlined the risks industry faces from the use of illicit drugs.



Steve Williams highlighted the workplace drug detection, education and prevention programmes offered by the NZDDA.

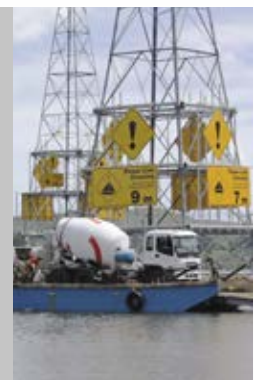
South Island Chair Brian Godfrey and Secretary Appie Boren outlined their plans to develop a road show for the South Island in 2013 that will offer members professional development opportunities.

Updates from the other NZRMCA regions will feature in the next issue of this newsletter.

### CONCRETE TRUCK PHOTO COMPETITION

In response to several requests the closing date for the concrete truck photo competition outlined in the previous issue of this newsletter has been extended to Friday 1 March 2013.

This should give you plenty of time to email a high-resolution image (1 MB or larger) of a concrete truck in a unique or challenging environment to the editor - adam@ccanz.org.nz



### NZRMCA WELCOMES NEW EXECUTIVE OFFICER

At the recent Annual General Meeting, held on 11 October 2012 in Hamilton, Adam Leach was appointed to the position of NZRMCA Executive Officer.

Adam's appointment followed a transition phase, during which he attended numerous regional and council meetings.

Previous Executive Officer, Rob Gaimster, will still be on hand to provide technical assistance, and will continue to be active in NZRMCA matters.

Building on the tremendous work under taken by Rob, it is anticipated that this arrangement will ensure NZRMCA services to members remain strong across administrative and technical fields.



Rob Gaimster



Adam Leach



*Te Radar - MC for the 2012 NZRMCA Awards*

## NZRMCA AWARDS 2012

The 2012 NZRMCA Awards were presented during the New Zealand Concrete Conference formal dinner held at Claudelands Conference and Exhibition Centre in Hamilton on 12 October.

The ceremony, presided over by the very popular Te Radar, included the Technical Excellence Award, the Extra Distance Award, and the Plant Audit Scheme Supreme Award.

As with previous years the judging panel, made up of David Barnard (NZRMCA), Sheldon Bruce (NZ Concrete Society) and Adam Leach (CCANZ), was faced with a task made extremely difficult by a range of

high calibre entries that demonstrated the expertise, determination and passion of those who work in the ready mixed concrete industry.

Both the Extra Distance and Technical Excellence Awards were given in recognition of a ready mixed concrete project or initiative that demands uncompromising commitment to customer satisfaction and calls for innovative solutions respectively. The challenges associated with each entry, and the solutions to overcome those challenges, are evaluated to determine the award winner.

## PLANT AUDIT SCHEME SUPREME AWARD

### COUNTIES READY MIX - DRURY PLANT



*Brett Beatson accepts the 2012 Plant Audit Scheme Supreme Award from NZRMCA President Jeff Burgess*

Over an extended period of time the Drury plant has demonstrated continuing excellence in performing to NZS3104 Specification for Concrete Production.

The plant, chosen from 26 other plants achieving 100% compliance, is an example to all other ready mixed concrete producers throughout New Zealand.

Concrete plants across the country are assessed for compliance over a two year period. This includes six testing frequency reports, two annual reviews of results and one physical audit review of the plant.

Quality control was the primary reason for the establishment of New Zealand Ready Mixed Concrete Association and the development of the Plant Audit Scheme over 40 years ago, and the audit scheme remains the cornerstone of the Association.

The plants listed below all achieved 100% compliance.

#### Zone 1 - South Island

Allied Nelson  
Allied Christchurch  
Allied Rangiora  
Allied Culverdon  
Allied Renwick  
Firth Amberley  
Firth Geraldine  
Higgins Richmond

#### Zone 2 - Wellington

Allied New Plymouth  
Allied Palmerston North  
Allied Wanganui  
Higgins Porirua  
Higgins Palmerston North  
Mobile Concrete  
Terry's Concrete, Te Horo

#### Zone 3 - Northland/Auckland

Allied Penrose  
Atlas Ruakaka  
Atlas Kumeu  
Atlas Takapuna  
Atlas Panmure  
**Counties Drury**  
Holcim Avondale  
Stevenson Penrose

#### Zone 4 - Central North Island

Allied Rotorua  
Allied Tairua  
Allied Whitianga







## EXTRA DISTANCE AWARD – WINNER

### ALLIED CONCRETE LTD FOR THE NEWMARKET VIADUCT REPLACEMENT



Bob Officer accepts the 2012 Extra Distance Award from NZRMCA President Jeff Burgess

As one of the most complex and visible construction projects undertaken in New Zealand, the Newmarket Viaduct Replacement impacts 215,000 road users everyday on the busiest stretch of motorway in the country.

The NGA Newmarket team was formed to deliver the project for the NZ Transport Agency. In 2008 it took on the challenge of pioneering a

world first; constructing the new - while deconstructing the old - 690m metre long Newmarket Viaduct, 20m above ground level.

Allied Concrete was selected as the sole concrete supplier for the new Newmarket Viaduct, which was begun in 2009 and completed in January 2012. Allied Concrete was required to supply more than 42,000m<sup>3</sup> (8,500 truck loads) of concrete as well as grout and shotcrete for structures including pad foundations, pier bases and heads, barriers, piles and 468 precast viaduct segments.

#### Judges' Comments

*The manner with which Allied Concrete worked seamlessly as part of the wider project team to solve a range of technical and logistical challenges was impressive.*

*The concrete volumes involved in replacing the viaduct were significant. The mix designs required to overcome issues in precasting the structure's segments and stitching them together, were complex.*

*In addition, by managing hazardous working conditions with difficult site access and tight timeframes, Allied Concrete have more than exceeded expectations of reliability on a high-profile project subjected to media and public scrutiny.*





## TECHNICAL EXCELLENCE AWARD – WINNER

### FIRTH INDUSTRIES LTD FOR THE TE MIHI GEOTHERMAL POWER STATION



Jon Hambling accepts the 2012 Technical Excellence Award from NZRMCA President Jeff Burgess

After a brief tender and negotiation period Firth Industries was awarded the ready mixed concrete supply to the largest geothermal power project in New Zealand's history.

The \$750 million, 166 MW twin turbine project was designed and built by a consortium of companies that included McConnell Dowell, SNC-Lavalin and Parsons Brinckerhoff (together known as MSP JV). The power station owner Contact Energy intends to use the new

generation capacity to replace the 53 year old Wairakei power station.

Over a very busy 12 months, Firth Industries transformed its small rural plant into a modern, high output facility to produce in excess of 18,000m<sup>3</sup> of extremely high spec concrete. With significant pours requiring up to 5 testing and quality control personnel, and operating within tight tolerances, this project placed a premium on technical excellence.

#### Judges' Comments

*The scale and scope of this infrastructure project immediately elevates its significance, which together with the demands that the geothermal environment placed on concrete design and production, made Firth Industries' achievements all the more commendable.*

*Upgrading a small plant in a short timeframe to accommodate a dramatic increase in concrete output, as well as controlling a large range of sophisticated mix designs specific to the site's unique durability challenges, were key to the project's success.*

*Enhanced batching accuracy and rigorous testing regimes further demonstrate an uncompromising awareness of the importance of concrete quality and in turn a strong commitment to a technical excellence that warrants recognition.*





## TECHNICAL EXCELLENCE AWARD – HIGHLY COMMENDED

### ALLIED CONCRETE LTD FOR THE TRI-COLUMN AT AUT BUSINESS SCHOOL



Opinder Saggi accepts the 2012 Technical Excellence – Highly Commended Award from NZRMCA President Jeff Burgess

As part of the new learning precinct building at AUT City Campus (located at the corner of Mayoral Drive and Governor Fitzroy Place), the tri-column is a unique piece of architectural infrastructure at the leading edge of construction technology in New Zealand.

The upside down triangle (tri-column) commissioned by AUT University, was designed by Beca Consultants and Jasmax Architects,

while Dominion Constructors (sub-contractors to Fletcher Construction) were responsible for the build.

The tri-column contract specification requested a F6 finish, without the appearance of construction joints with minimum air bubbles. Dominion Constructors spent a couple of month's trialling different concrete suppliers to complete the pour as per requirement, finally selecting Allied Concrete as the preferred supplier.

#### Judges' Comments

*With such a visible piece of construction, intended to draw attention to its own unique form and finish, there was little room for error in concrete mix design and construction practices.*

*Allied Concrete has demonstrated advanced technical understanding of self-compacting concrete by adapting the material's properties to achieve full compaction and combat potential mix segregation in order to attain the surface finish specified.*

*Working closely with its project partners in areas such as formwork design, Allied Concrete has helped produce what will surely become an iconic structure on campus.*





## ATLAS CONCRETE RECYCLING PLANT – A SUSTAINABLE APPROACH

An established presence in the Auckland market, Atlas Concrete has recently developed its concrete recycling facility in a demonstration of their commitment to sustainable business practices.

The facility is located on a 9300m<sup>2</sup> site in Albany, and complements the company's existing concrete supply business in an effort to provide a full life-cycle approach to their concrete products.

Glen Cossey, a senior structural engineer with Markplan Consulting Ltd, which managed the detailed design alongside Atlas Concrete who constructed the facility, believes it will play an important role in minimising waste going to landfill. "By providing an opportunity to substitute quarried materials with recycled crushed concrete Atlas Concrete is helping to conserve natural aggregate resources," says Glen.

The facility can process demolition concrete into crushed concrete and drainage concrete of various sizes, a process that also involves extracting the (recyclable) reinforcing steel. In addition, returned concrete from the Atlas fleet of trucks can be left to cure prior to crushing, or formed into new mass concrete blocks.

The recycling facility also incorporates a range of measures to minimise its day to day environmental impacts, such as dust mitigation by way of timer controlled sprinklers that use collected stormwater. Similarly, stormwater runoff is treated to meet Auckland Council requirements,

while an on-site closed loop truck wash down mechanism also makes use of stormwater.

Seeking to minimise noise and air quality issues the crusher plant building, itself fabricated from 100% recycled steelwork, incorporates acoustic insulation and dust treatment devices. The facility's paint and planting schemes are designed to blend with the surrounding environment.

The recycling facility features many forms of durable concrete construction. For instance, the concrete yard, with its compacted crushed concrete sub-base, can accommodate frequent use by heavy vehicles.

Mass concrete blocks constructed from returned concrete form the aggregate bins. The stormwater treatment device and all retaining structures are constructed from similar blocks, supplemented with reinforced sprayed or cast in-situ concrete to create the structural form.

Atlas Concrete Chief Executive Graham Collie is justifiably proud of the new facility. "We have created Auckland's only permanent, large scale concrete recycling facility, which enables us to minimise our environmental impact by reducing waste levels - and what's more we did it using concrete as the primary construction material," says Graham.





## CARDBOARD CATHEDRAL – ON A SOLID FOUNDATION

Work is now complete on the concrete foundations of the transitional and controversial 'cardboard cathedral', located on land owned by the Anglican Church property trust on the south-east corner of Madras and Hereford Streets.

Under the direction of main contractor Naylor Love, Ashby's READY mixed, with assistance from sister company Allied Concrete, delivered to site approximately 720m<sup>3</sup> of concrete, the equivalent of around 150 truckloads. Beginning at 4:00am, the marathon concrete pour lasted 7-hours.

At 900mm deep the foundations also contain about 120 tonne of reinforcing steel to ensure optimum seismic resistance.

Ashby's READY mixed were more than happy to be involved in such a high-profile project, unique amongst buildings world-wide, points out Allied Concrete's National Sales & Marketing Manager Glen Paterson.

"Ashby's READY mixed has a strong presence in Christchurch, as does Allied Concrete, so we are extremely pleased to form part of the team that is bringing this unique structure to life," says Glen.

In addition to the substantial concrete foundations, the cathedral has gained much media coverage as a result of the 320, 6m long, 600mm diameter, 120kg cardboard tubes that will comprise the distinctive A-frame design.

Although covered by a polycarbonate roofing material, the cardboard tubes require three coats of polyurethane to ensure additional waterproofing. Structural integrity will be ensured through the use of both steel framing, and LVL within each tube.

Designed by renowned Japanese architect Shigeru Ban, the brief stipulated a sustainable, safe, durable, beautiful, innovative and versatile building that was entirely compliant with the New Zealand building code, including a design life of at least 50-years.

Finance for the \$5.3 million build is covered by a \$4 million insurance pay-out from the ChristChurch Cathedral (although this is under review), while the majority of the additional \$1.3 million is made up of time, labour and materials provided gratis by a number of local contractors and suppliers.

Having got off to a late start due to concerns about the weather, structural elements of the cathedral will be assembled off-site and then transported to site for erection.

It is anticipated that the frame will be essentially complete by Christmas, with the 700-seat capacity building ready for use in February 2013.





## Concrete<sup>3</sup>



Economic, Social, Environmental



## CHRISTCHURCH CIVIC BUILDING WINS 2012 SUPREME CONCRETE<sup>3</sup> SUSTAINABILITY AWARD

Athfield Architects has taken out the 2012 Supreme Concrete<sup>3</sup> Sustainability Award for its extensive refurbishment of the new Christchurch Civic Building on Hereford Street.

The award, presented at the annual New Zealand Concrete Conference in Hamilton, recognised the transformation of what was the New Zealand Post Building into an architectural statement that adds tremendous value to Christchurch, says Cement and Concrete Association of New Zealand (CCANZ) Chief Executive Rob Gaimster.

The judging panel applauded Athfield Architects for the way in which significant changes were made to the existing concrete building, creating spectacular work and interactive spaces without losing the original architectural and industrial heritage.

"This is a truly outstanding example of adaptive reuse, one which demonstrates the flexibility of concrete as a sustainable construction material. It continues the emerging trend in New Zealand of optimising resources and enhancing the built environment through the innovative refurbishment of our existing concrete building stock," says Rob.

The design reconfigured the building's existing service and transportation cores, and added mezzanines to the main office levels. The existing precast concrete cladding panels from the southern facade were removed, reworked and reused on the northern side to create a completely new extension with double skin facade, and circulation stair and winter gardens behind.

Despite the significant changes, the design retains and celebrates the building's original Brutalist style.

"The new construction materials read deliberately as distinct insertions, to set up a contrast between old and new, providing visual interest and complexity," adds Rob.

The Christchurch Civic Building is the first to receive a 6 Green Star Office Design rating, further testament to the project's successful outcome.

On their way to the top prize, the Athfield Architects team were also presented with the **Excellence in Commercial Concrete Construction**.

The Awards are part of the Concrete<sup>3</sup> initiative launched in 2007 by CCANZ, and acknowledge projects, products or initiatives which demonstrate excellence in environmental, economic and/or social sustainability for the built environment.

### OTHER CATEGORY WINNERS

The awards also produced winners in four other categories for projects which excelled in different areas of sustainable concrete construction.



**Excellence in Concrete for the Community** went to Tennent + Brown Architects for Nga Purapura in Otaki. Te Wananga-O-



Raukawa, a Maori tertiary institution, required a building to fulfil its vision for courses focused on improving physical well-being for Maori.

The project strategy involved the extensive use of resilient precast concrete as the primary cladding material. Produced locally, using Otaki gravel, pre-tensioned precast concrete provided a reduced construction programme and minimised lifecycle costs through its durability in a coastal environment.

The building's most striking feature is the sandblasted patterns on the exterior panels, which communicate the project's Kaupapa of Māori health and well-being to the wider community.

**Excellence in Concrete Innovation** was awarded to Allied Concrete Limited for its Recycled Glass Sand Initiative. The company has converted three of its plants to be able to use crushed glass as a sand replacement in a selection of lower strength concrete mixes.



*Bob Officer accepts the Excellence in Concrete Innovation Award from CCANZ Chair Ross Pickworth*



The environmental benefits resulting from the kerbside collection, processing and use of waste glass in concrete include landfill life extension, reduced transportation of recycled materials and conservation of natural resources.

**Excellence in Civil Concrete Construction** was won by Fulton Hogan Limited for the Huntsbury Reservoir in Christchurch. Following the February 2011 earthquake, which severely damaged the reservoir and resulted in the total loss of stored water from the 35,000m<sup>3</sup> structure, the reinstatement of as much water storage as feasible was urgently required.



The design and construction method adopted allowed for the reuse of the existing concrete external walls, roof slab, foundations and floor slab, as well as work to add seismic resilience. The reuse of demolition concrete waste was crucial to the material minimisation plan with concrete crushed on site and reused as fill in various locations.

**Excellence in Residential Concrete Construction** was awarded to Ponsonby architecture company Matter for a premier residential property on a picturesque but steep site in Point Chevalier, Auckland.



The foundations and the house structure are built around a concrete raft slab and sandwich panel arrangement, with the raft slab offering seismic resilience while also being a key element of the overall passive solar design.

The mass of the sandwich panels also help to prevent dramatic fluctuations in the house's internal temperature, while providing retaining capability for the site.

Simplicity of design has been realised through the intelligent use of versatile concrete to create a stylish and functional family home on a difficult site.

For more information about the Concrete<sup>3</sup> Awards, go to [www.sustainableconcrete.org.nz](http://www.sustainableconcrete.org.nz)





## PRACTICAL RESEARCH – THE DEVELOPMENT OF CONCRETE

CCANZ CEO, Rob Gaimster, examines the evolution of concrete over the previous two centuries, highlighting how a commitment to innovation has seen concrete constantly adapt to new demands and become the world's most widely used construction material.

Since Joseph Aspdin obtained the patent for Portland cement in 1824 the concrete industry, driven by commercial and environmental demands, has endeavoured to transfer research accomplishments from the laboratory into practice.

The progress of technical innovation has followed an almost linear path, displaying all the textbook traits of being at times "radical" and at others "incremental", or to borrow leading competitive strategist Michael Porter's terminology "discontinuous" and "continuous".

The outcomes have made possible a range of high-performance concretes that are transforming building disciplines, and ensuring concrete remains a key contributor to a sustainable built environment.

Almost any type of concrete is now possible, from ultra-strong, self-compacting and bendable, to translucent, depolluting and recyclable.

### CONSTITUENT MATERIALS

Advances in cement and admixture technology have been dramatic over recent decades. Huge investment in research has led to improved manufacturing processes and an array of additives that help reduce environmental impacts and allow designers to fully exploit concrete.

Examples of efficiencies in cement manufacture include the use of alternative renewable kiln fuels and the growth of supplementary cementitious materials – industrial by-products or natural materials which when added to cement exhibit cementitious properties. This drive towards reducing energy use and emissions was further embedded with a recent update of NZS 3122 *Specification for Portland and Blended Cements*, allowing up to 10 per cent mineral addition (supplementary cementitious materials) in General Purpose cement.

While performance enhancing additives are not new (the Romans used animal blood for durability and workability) recent innovation has been prolific. Water reducers, grinding aids, corrosion inhibitors and water proofing

agents are just some of the admixtures now used to improve durability and placing times, reduce costs and enhance sustainability credentials.

### CONCRETE

Mirroring innovations in its constituent materials, concrete itself is undergoing constant development. The umbrella term *high performance concrete* captures the features of modern concrete, which include higher strengths, enhanced abrasion resistance and durability, low permeability and diffusion, improved resistance to chemical attack, and greater ease of placement.

One example of high performance concrete is *self-compacting concrete*, which was used in the NZ Transport Agency's Tauranga Harbour Link Stage 2 project. Self-compacting concrete flows under its own weight to fill formwork congested with reinforcing steel. Self-compacting concrete's benefits include a safer work environment with less mechanical vibration, greater flexibility for complex shapes and a homogenous finish.

*High strength concrete* is the product of sophisticated mix design that includes premium admixtures as well as particle packing to control porosity and permeability. Used in the shear walls of the Burj Khalifa, the world's tallest building, high strength concrete offers economic benefits through slender and lighter structural elements.

There has also been recent significant development in the role of fibres in concrete. *Fibre reinforced concrete* generally refers to concrete containing steel fibres and is predominantly used in industrial flooring applications due to its toughness and ductility. There are even instances where steel fibres have replaced conventional reinforcement in structures.

Advances in concrete technology have also led to some unusual varieties. *Bendable concrete* is a lightweight composite material that offers good tensile strength and ductility, and is available as a sheet or





can be applied via a shot-nozzle. Translucent concrete, available as non-structural blocks or panels, contains randomly embedded glass fibres that allow light transmission.

## SEISMIC STRUCTURAL DESIGN

In terms of seismic structural design, reinforced concrete has long been favoured by engineers to express new ideas. This is particularly so in New Zealand, where Canterbury University has nurtured some of the world's top structural engineers under the guidance of the late Professors Robert Park and Thomas Paulay.

As seismic structural design develops beyond "life safety" towards "building survivability", recent advances in damage resistant design using concrete systems are leading the way. These advances include the PREcast Seismic Structural System (PRESSS), which uses un-bonded post-tensioning cables and rocking joints within a precast frame to ensure the building returns to upright without significant structural damage, even after a major seismic event.

In response to structural earthquake demands even the humble concrete slab-on-ground for homes is undergoing development. With it now mandatory for all residential floor slabs to contain seismic grade reinforcing mesh, innovative "raft" slab designs are evolving.

Also within the residential space, and on display at the "HIVE" Home Innovation Expo in Christchurch, prefabricated concrete systems for safe and affordable houses are undergoing design enhancements prompted by interest following the Canterbury earthquakes.

## SUSTAINABILITY

Recognising the need for sustainable development the concrete industry has implemented innovative economic, social and environmental strategies. The CCANZ Concrete<sup>3</sup> campaign seeks to raise awareness of concrete's contribution to a sustainable built environment, while the Holcim Awards acknowledge innovative construction projects and future-oriented concepts.

Industry is also seeking new ways to meet the growing demand for products that allow for recycling. Developments centre on the reuse of wash-water from the production of ready mixed concrete and the uptake of recycled waste (e.g. demolition concrete) as aggregate in new concrete. The latter is illustrated by Lion Nathan's Pride facility in East Tamaki, which incorporates recycled waste glass as aggregate in concrete.

Also on display in Auckland, in the form of North Shore footpaths, is *pervious concrete*. Designed to reduce the flow rate of water entering the stormwater system to mitigate flooding, as well as filter out contaminants, pervious concrete provides a structurally sound pavement option.

*Depolluting concrete* is another emerging innovation. Incorporating nano-sized photocatalyst particles in the primary form of titanium dioxide (TiO<sub>2</sub>), depolluting concrete accelerates the natural and safe chemical reaction whereby strong sunlight or ultraviolet light creates an electrical charge that breaks down organic materials such as dirt, biological organisms (e.g. algae and mould), and air borne pollutants (e.g. smog). This innovation is helping to keep concrete clean and depolite the air across European cities, most notably in Rome where the Richard Meier designed Jubilee Church is its most striking example.

## FUTURE PRIORITIES

During the almost two centuries since Joseph Aspdin realised the potential of Portland cement, the wider concrete industry has achieved notable efficiencies through a commitment to innovation.

However, as the producer of the world's most widely used construction material, the industry must maintain this commitment to help balance commercial pressures and ecologically sound practices while the world transitions to a sustainable economy.

The challenges that face concrete are significant, and will require new ways of thinking, new definitions of success and new stakeholder engagement strategies.

*This article first appeared in the IPENZ's Engineering Insight.*





## CONCRETE INDUSTRY WORKSHOP CONNECTS ARCHITECTURE AND ENGINEERING STUDENTS

Architecture students from Victoria University and engineering students from the University of Canterbury recently took part in the inaugural ArchEng workshop, where they collaborated on the design for a cultural centre on Wellington's Cuba Street.

Organised by the Cement & Concrete Association of New Zealand (CCANZ), the initiative was conceived as a way to encourage aspiring construction specialists from different disciplines to work together to incorporate the best insights and latest technology into building design.

Dr Joe Gamman, CCANZ Education and Development Manager, says the ArchEng project is focused on connecting future architecture and engineering professionals.

"The better we're able to help these students work together, the better the outcomes are going to be for clients and society at large," he says.

The ArchEng workshop also aimed to demonstrate to the students how their fields interact at a practical level from a construction materials perspective.

"The students were able to really get a sense that good design and good engineering are one and the same," Dr Gamman says.

The students, working in cross-disciplinary teams of two, were challenged with a brief to develop a preliminary design for an inner city Wellington cultural centre, with concrete as the primary building material.

"We found a site on Cuba Street that looked as though it could be developed and we structured the programme around that," Gamman says.

The students were taken on a site visit to familiarise themselves with the location and the surrounding context, so that their designs would more intuitively reflect the requirements of all stakeholders.

Grace Mills, a final year VUW architecture student says, "It was good to see the site from a design perspective and start to talk to others about how they see it as a potential space for a cultural centre."

"You get to look at a problem from a completely different angle than we are used to at university," adds Cameron Belliss, a final year University of Canterbury structural engineering student.

The workshop ran over three days and included site visits to inspirational concrete buildings in Wellington including the Alan MacDiarmid Building, which utilises the PREcast Seismic Structural System (PRESSS), and the Meridian Building, New Zealand's first 5 Green Star rated building.

The site visits were guided by practicing engineers and architects who were involved in the design and build at each site.

Workshop panellists included representatives from BRANZ and the Ministry of Building Innovation and Employment, with both organisations keen on increasing productivity and communication in the built environment.

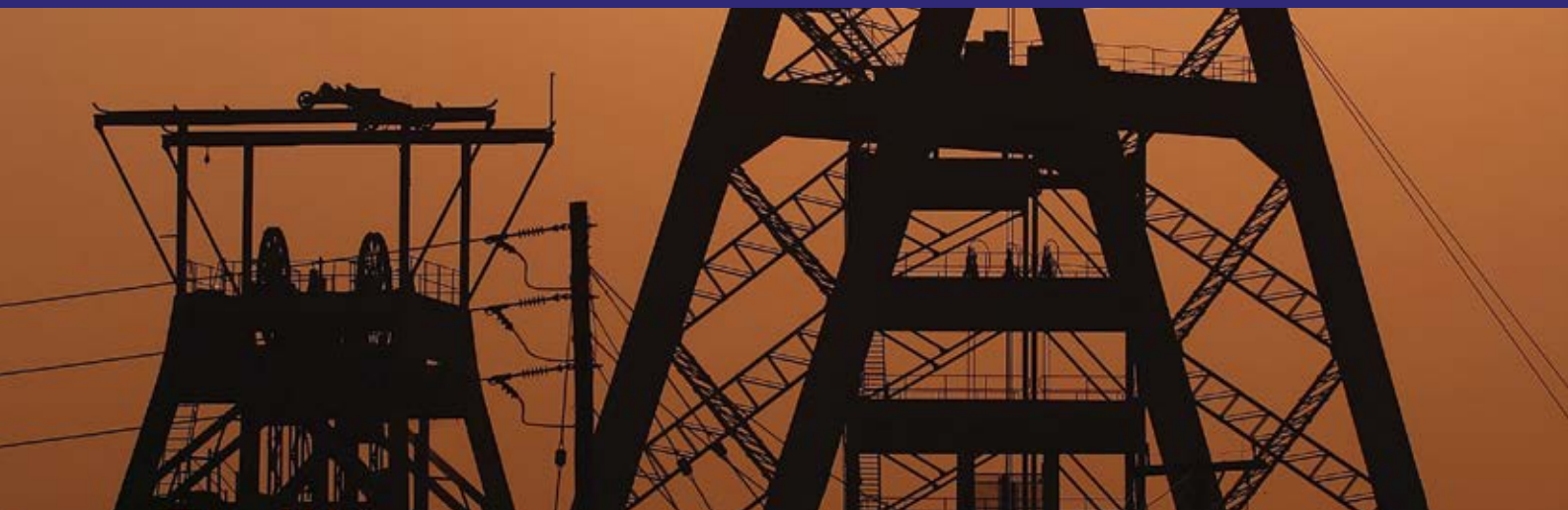
It is anticipated that the workshop will become an annual event as CCANZ continues to foster cross-disciplinary contact between early career professionals for better concrete outcomes.

Future CCANZ ArchEng workshops will continue to:

- showcase design and build opportunities of relevance to the host cities of Wellington, Christchurch and Auckland;
- promote increased productivity and sustainability in the building and construction sector;
- allow industry associations to promote the benefits of working collaboratively between disciplines and inform and educate the next generation of professionals; and
- allow employers to participate in a creative event and meet and interact with New Zealand's top graduating engineers and architects.

A short film showcasing the objectives and achievements of the ArchEng workshop can be accessed via the CCANZ website [www.ccanz.org.nz](http://www.ccanz.org.nz).





*Lafarge Ready Mix trucks waiting to place concrete after a two hour delay.*

## HIGH-SPEED MISSION TO AVOID POTENTIAL MINING DISASTER

Placing 1,200m<sup>3</sup> of concrete over nine days, through a pipeline that reaches a 133m drop – with a portion of the concrete placed in water – is a feat few would attempt. However, Lafarge Ready Mix successfully completed this task thanks to a skilled, committed team and a top-quality concrete mix containing Chryso admixtures.

A 300mm diameter hole was detected in an underground wall of a mine in Mpumalanga. Behind this wall was a massive reservoir, and water was leaking out of the hole at a rapid rate – creating the risk of flooding the mine.

Roedolf van Wyk, senior engineer at Mantella Trading 310, helped to develop a solution to stop the water from pouring into the mine. “We decided to place twelve, 4m thick and up to 4.5m high and 7m long concrete walls (concrete plugs) at strategic locations in the mine. A total of 1,200m<sup>3</sup> of concrete had to be poured over nine days and the concrete had to reach a rapid early strength of 15MPa on the first day, with a final strength of 40MPa after 28 days.

It was established that Lafarge’s Evander Plant in Mpumalanga had the capacity to provide the required volume of concrete and the ability to meet all the technical specifications. Lafarge’s ready mix product, Agilia, was used for the project. This self-compacting concrete allows for placing without difficulty,” says Van Wyk.

A Chryso set accelerator helped the mix to reach the required 15MPa strength on the first day, ensuring that the concrete would gain strength within required time. Also incorporated into the mix was a Chryso

anti-washout agent specifically designed for concrete to be placed under water – thus preventing the cement and finer particles from leaving the concrete mix.

“The concrete pumps and pipes had to operate while standing in large volumes of water and mud. Concrete was poured into a funnel at ground level and was dropped into receiving kettles 133m underground through a 127mm steel-encased borehole. Once underground, the concrete was placed using a Putzmeister pump. Not all the concrete walls could be placed in a single pour due to the timber shuttering and brattice wall waterproofing system. Thus, the concrete pipes had to be installed or moved up to four times per plug.

“Both the mine and Mantella Trading 310 were very impressed with the quality and volume of work Lafarge produced within the short time frame. The client did not have to wait for a single Lafarge delivery. The concrete mix was a great success and was workable and pumpable for as long as six hours after batching,” explains Van Wyk.

“The concrete had to be a cohesive, sticky self-compacting mix that would not block any of the pipes. This was achieved by using two Chryso superplasticers. The superplasticers were ideal for self-compacting concrete, and also acted as a set retarder that helped the concrete to retain its workability for an extended period. They made a tricky job possible,” concludes Van Wyk.

*Article reproduced with kind permission of the South African Concrete Institute.*



## KEY DATES

### NZRMCA 2013 NATIONAL COUNCIL MEETINGS

| MEETING | DATE                      | TIME            | VENUE                  |
|---------|---------------------------|-----------------|------------------------|
| Council | Thursday, 21 February     | 9:30am – 3:00pm | Taupo                  |
| Council | Wednesday, 15 May         | 9:30am – 3:00pm | CCANZ, Wellington      |
| Council | Wednesday, 14 August      | 9:30am – 3:00pm | CCANZ, Wellington      |
| AGM     | Thursday, 3 October (TBC) | TBC             | Conference, Queenstown |
| Council | Wednesday, 13 November    | 9:30am – 3:00pm | CCANZ, Wellington      |

## FUN (CONCRETE) FACT

### TWO UNEXPECTED ADDITIONS TO WELLINGTON'S WATERFRONT

What do concrete, kina, dwarfs and a hobbit have in common? Ordinarily, nothing!

However, take a stroll down to the Wellington waterfront and you will see two new sculptures enthraling visitors and locals alike.

Immediately next to the Meridian Building in the Kumutoto precinct sits the recently installed *Nga Kina*, a collection of nine colossal concrete kina (sea urchins) created by sculptor Michael Tuffery, and constructed by GRC New Zealand Ltd.

Attached to the seabed, the massive kina-shaped objects share their secrets with the rise and fall of the Wellington harbour's tide.

A complex lighting system adds to the sense of mystery the sculpture brings to the small marine inlet where the Kumutoto stream meets the Wellington harbour.

Created in Auckland, and trucked down to Wellington, the largest of the kina weighs in at 7.5 tonnes, with a diameter approaching 3.5m.

Skillful crane operation was required to lower and secure each of the kina into position. Neil Plimmer, head of the Wellington Sculpture Trust, has declared the finished arrangement "just perfect".

Unique in terms of scale, the \$340,000 concrete work of art was funded by a partnership between the Wellington Sculpture Trust, the Wellington City Council and a large number of private donors.

The kinas extend the Wellington waterfront's collection of sculptures to its most northern point, and was officially unveiled in late November.

While standing and admiring the artistic work of Tuffery, a quick glimpse up at the NZ Post building on Waterloo Quay reveals a silhouetted line-up of thirteen dwarfs and a hobbit, all of whom rely of concrete to remain securely in place.

Created by Sir Richard Taylor's Weta Workshop in response from a request by NZ Post senior management, the installation took a team of eight designers an entire month to create.

Positioned on the 5th floor of the building, the fourteen figures form a striking procession at night.

Conceived as a way to celebrate both the world premiere of Sir Peter Jackson's *The Hobbit: An Unexpected Journey* and NZ Post's Hobbit themed stamp collection, the figures posed a significant engineering challenge, which could only be overcome through the use of concrete.

Confronted by wind load requirements dictated by potential 140kph gusts, engineering consultants specified 56 tonnes of concrete to anchor the plywood cutouts and prevent them from being blown away from the middle of Middle Earth.



*Nga Kina in the foreground, with the procession of dwarfs led by a hobbit on the NZ Post building in the background.*