2016 NZRMCA AWARDS
CELEBRATING EXCELLENCE IN READY MIXED CONCRETE
Kia ora readymixers,

Welcome to the latest NZRMCA Newsletter; and my first as President.

The annual New Zealand Concrete Conference has come and gone in a blur - as it always does. The combination of technical presentations, trade exhibits (including practical demonstrations), networking opportunities and social engagements make for a very busy, but rewarding few days.

The NZRMCA con-current sessions provided an interesting array of papers that complimented those offered in the main sessions, while the NZRMCA Annual General Meeting was lively.

In terms of the latter; the usual committee and regional reports were filed, along with the passing of two important resolutions / remits.

Firstly, a communication protocol with the Ministry of Business, Innovation and Employment (MBIE) was inserted into the Plant Audit Scheme (PAS) by-laws. The new Clause requires the Plant Audit Committee to report to MBIE on an annual basis as well as when there is a ‘significant lapse in quality’, a definition of which was also included.

In addition, the requirement for a PAS plant to retain records for 7 years, and for the minutes of the Plant Audit Committee to be kept for 15 years and all other records of the Committee for 7 years, was inserted.

A remit to sanction the NZRMCA’s involvement in the current association consolidation process was approved, along with granting authorisation for the Council to progress consolidation moving forward.

Both these developments are positive indications that the NZRMCA is committed to strengthening the quality assurance core of the PAS, as well as positioning the ready mixed sector to play a major role in future pan-industry association activity.

At the AGM my predecessor Brian Godfrey gave the Association’s Annual Review. By way of a quick run-down, the 2015/16 NZRMCA business year covered many areas of interest for the ready mixed concrete sector. We continued as part of the BCITO concrete National Advisory Group (NAG), and played an active role in drafting their soon-to-be released Ready Mixed Concrete Manufacturing - Workforce Development Plan.

The NZRMCA were the primary funder of a full revision to NZS 3121:2015 Water and Aggregate for Concrete, which was published in December 2015 to replace the dated 1986 Standard. We also remained committed to assisting Cement & Concrete Association of NZ (CCANZ) projects, the outcomes of which help create opportunities for ready mixed concrete.

Consolidation aside, the upcoming 12-months will be busy for the NZRMCA with a number of projects from 2015/16 flowing over into 2016/17, such as the automation of the Plant Audit Scheme. Promotion of the Scheme will also continue - a priority as construction material quality remains a topic of interest with media and the regulator.

Recently there has been a raft of changes in terms of regional Chairs, and in turn Council. Kerry Newton has replaced Craig Nisbet in Northland, Graham Collie takes over from Scott Williams in Auckland, Mark Hastie steps into my shoes in the Central North, while Richard Sands assumes the role in the South Island from Aaron Charteris.

I look forward to leading the Association over the next few years, during which time I am sure we will tackle a range of issues and endeavour to provide solutions that help secure useful outcomes.

Paul Donoghue
NZRMCA President
Technical Note 3 Water and Aggregate for Concrete

The increasing level of urbanisation across New Zealand has led to a growing interest in pervious concrete as a sustainable solution for storm water management. Pervious concrete is designed to allow water to pass through it, mimicking the natural infiltration characteristics of soil. This reduces storm water runoff and helps manage water quality by promoting infiltration into the ground rather than discharging it into rivers and streams.

With the 2015 revision of NZS 3121: Water and Aggregate for Concrete, there was a requirement for this document. The NZRMCA Best Practice - Delivery to Site is the focus of the next section.

NZRMCA Best Practice - Delivery to Site

The Health & Safety At Work Act came into force on 4 April 2016. As a result of the changes there will be:

- A greater accountability for businesses and individuals
- A greater requirement for everyone (including contractors) on site to work together to stay safe - consult, cooperate and coordinate

The NZRMCA remains committed to assisting Members continually improve their health and safety practices, particularly in terms of delivering ready mixed concrete (a hazardous product) to site. As such, a Safety Alert – Concrete Delivery to Site has been produced with assistance from Firth Industries. The leaflet covers important new safety protocols, including Q+Ax templates for concrete delivery to site, as well as for receiving an order.

The safe handling of wet concrete is also covered in an abbreviated material safety card.

Safety Alert – Concrete Delivery to Site can be downloaded from the NZRMCA website - www.nzrmca.org.nz

NZRMCA Technical Notes

The NZRMCA has recently added to its series of Technical Notes with:

- Technical Note 8 Chloride Testing of Concrete
  
  With the 2015 revision of NZS 3121 Water and Aggregate for Concrete the NZRMCA Technical Committee felt that there was a requirement for this document.

  Which New Zealand Standards set out requirements for testing of chloride in concrete are outlined, along with what test methods are available, the required frequency of these tests, and their anticipated level of accuracy.

- Technical Note 9 Pervious Concrete
  
  The increasing level of urbanisation across New Zealand has led to a growing interest in pervious concrete as a means to manage storm water run-off. This document outlines the properties of pervious concrete (e.g., infiltration rate), testing and acceptance criteria (i.e., workability, compression and density and void content), as well as hardened testing methods for void content and infiltration rate.

Both these Technical Notes can be downloaded from the NZRMCA website - www.nzrmca.org.nz

Please note that Technical Note 3 Water and Aggregate for Concrete has been withdrawn indefinitely pending review.
VDAM RULE CONSULTATION

In February 2016 the NZRMCA responded to the Ministry of Transport (MoT) and the New Zealand Transport Agency’s (NZTA) Review of the Vehicle Dimensions & Mass (VDAM) Rule - Discussion Document.

In short the NZRMA urged for special dispensation and increased axle mass limits for concrete mixer trucks.

The aim of the document is to make the heavy vehicle transport regime work better for New Zealand. Proposals in the document focused on changes to general requirements for dimension and mass limits, permitting and access conditions, and management of over-dimension loads.

The resulting (yellow) draft of Land Transport Rule: Vehicle Dimensions and Mass (2016) was made available for public consultation in July. This draft identified concrete mixer trucks as a Specialist Vehicle; a development that in certain circumstances could allow for efficiencies.


ASSOCATION CONSOLIDATION

At the NZRMCA AGM held on 6 October 2016 at the New Zealand Concrete Conference (Elderslie Events Centre in Auckland) Members voted in favour of the remit below, which endorsed consolidation into a single association, known as Concrete NZ, and empowered the NZRMCA Council to ensure the transition.

BACKGROUND

The NZRMCA Council has been working with other industry organisations on a proposed industry consolidation that will involve:

- The formation of a new incorporated society to be called Concrete New Zealand Incorporated (CNZ);
- Members of the NZRMCA becoming members of CNZ;
- The transfer of NZRMCA assets, and the carrying out of its activities, to CNZ;
- The winding up of the Association (subject to CNZ satisfying certain agreed performance criteria during the agreed transition period).

The purpose of the consolidation is to provide a better and more effective vehicle for the attainment of the contributing organisations’ objects/purposes through more efficient use of resources, reduced administration costs, and working together with other industry participants.

REMIT

With the formal adoption of the remit at the AGM, the NZRMCA Council is now authorised to:

- Approve on behalf of the Association the proposed rules for CNZ.
- Determine the terms on which the Association’s assets, and the performance of its activities are transferred to CNZ.
- Enter into and execute such documents as maybe required in connection with the Consolidation, on such terms and in such form as the Council thinks fit.

NZRMCA representatives Bob Officer and Jeff Burgess will remain on the consolidation Working Group developing a transition plan to be implemented over the next 12 months.
ORDERING PRACTICES KEY TO REDUCING CONCRETE DELAYS

The Auckland construction market is experiencing its strongest growth in 40 years. This has led to substantial pressure on a range of building products, with ready mixed concrete (RMC) lead times around three weeks for prime time bookings.

CCANZ Chief Executive Rob Gaimster says that “In addition to the level of construction activity in Auckland, other factors contributing to frustrations around RMC supply amongst customers include a truck driver shortage, restrictive supply 'windows' in residential areas, traffic congestion and customer ordering practices.”

“When combined with concrete’s unique nature and short shelf-life of around 90 minutes in its plastic state, these factors have created a very difficult and challenging situation for both RMC suppliers and their customers,” says Rob.

“A customer’s RMC order is bespoke and must be ordered in advance in much the same way as other custom products such as roof trusses and window joinery.”

“Investment by RMC suppliers across Auckland in plant and personnel has been significant over recent years, and is therefore not considered a contributing factor,” adds Rob.

“RMC suppliers are however encouraging their customers to adopt a range of practices that will enhance accuracy and efficiency in terms of ordering, and go some way to alleviating current frustrations around supply,” says Rob.

**ORDERING PRACTICES**

- Place your order well in advance, and make it as accurate as possible.
- Eliminate the following practices:
  - Placing ‘ghost’ or ‘phantom’ orders.
  - Under / Over-ordering simply to get an order scheduled.
  - Cancelling your order within 48 hours (weather conditions aside).
  - Significantly reducing your order size within 48 hours of delivery.
  - Significantly increasing your order size within 48 hours of delivery.
  - Ordering small loads (where you can avoid it).
- Work with the RMC supplier to schedule a delivery time which works for all (some RMC suppliers have spare capacity either earlier or later in the day).
- Understand that RMC suppliers may seek confirmation of your order 48 hours out (time and volume of concrete required) and that confirmed orders are likely to take priority for dispatch.
- Ensure the concrete pump (if required) is ready to operate when the first RMC truck arrives on-site.
- Discharge deliveries as quickly as possible.

“To help ‘on-time’ performance within the challenging Auckland environment attention to detail when planning concrete pours (timing and volume) is crucial,” says Rob.

“RMC suppliers place tremendous value on their customer relationships and believe that adopting more accurate and efficient ordering protocols will assist in easing supply concerns to the benefit of all.”
KEVIN MISCHEWSKI - NZRMCA HONORARY LIFE MEMBER

AFTER MANY DECADES OF SERVICE TO THE NEW ZEALAND READY MIXED CONCRETE INDUSTRY KEVIN MISCHEWSKI OF STEVENSON CONCRETE RECENTLY ANNOUNCED HIS RETIREMENT.

It seemed only fitting to recognise Kevin’s significant industry and association contribution with an NZRMCA Honorary Life Membership at the recent AGM held in Auckland.

NZRMCA President Brian Godfrey presented Kevin with his certificate and award, while David Lowe and Graham Payne shared recollections of having worked with Kevin.

Kevin acknowledged the NZRMCA Membership in attendance and offered his thanks to all those who had supported him over the years, before signing-off with a few sage observations.

The NZRMCA wishes Kevin all the very best in his retirement, and extends an open invitation to future regional meetings and conference/AGMs.

To further celebrate Kevin’s influence, as well as share moments from his interesting life in concrete, the following are extracts from David Lowe’s speech.

Born in Raetahi, Kevin’s initial schooling took place in Tokoroa before he moved to Auckland at the age of 13 to attend Papakura High School. Leaving school at aged 15 Kevin embarked on a panel-beating apprenticeship, remaining in that trade for close to a decade. It was however, on a trip to Australia with his brother that Kevin’s passion for concrete was ignited while spending three months hand mixing concrete for the Main Roads Department.

Upon returning to New Zealand circa 1970 Kevin became a concrete mixer truck driver for United Concrete, stationed at the very same Penrose yard where he is based today. At that time United Concrete was co-owned (50/50) by the Stevenson and Richwhite families.

Kevin started driving a 4yd Bedford truck, before progressing to a White, an International and then an ACCO. After three years at the Penrose plant Kevin moved to Takanini where he gained experience in testing, batching and despatching.

Transferring back to Penrose Kevin worked in despatch then order taking. In 1987 the Stevenson family acquired the Richwhite shares and re-branded the business with the Stevenson name. Kevin was promoted to Assist Manager in 1993 under Gordon Carnegie.

Following Gordon’s retirement in 1995 Kevin assumed the Manager role.

Around this time Kevin began his involvement with the NZRMCA. Over a 13 year period he served as the Auckland region Chair and a Council member, including two-and-a-half years as National President, taking over from (fellow Honorary Life Member) Fred Thomas in 2002.

Kevin remained on the Council for several years as Immediate Past President, after which he maintained close ties with the Association’s activities in the Auckland region. Kevin remains unwavering in his support for the NZRMCA, and all that it seeks to achieve on behalf of the ready mixed concrete industry.

Over the years Kevin has held almost every role at Stevenson Concrete, gaining an in-depth knowledge of all aspects of the concrete industry. This experience coupled with a willingness to offer input means Kevin is a tremendously valuable asset to Stevenson Concrete. His recent roles have been hard to label. You can’t really have “The Go-To-Guy” on a business card.

In June Kevin announced he would retire from Stevenson Concrete at the end of 2016, bringing the curtain down on a long career. Stevenson Concrete has endeavoured to facilitate the sharing of Kevin’s expertise with staff, particularly the younger members. However, extracting and relaying this information is proving difficult as the quantities are vast and its nature complex.
Kevin has often commented on the many developments that have taken place within the concrete industry over the years, ranging from the introduction of admixtures through to computerised systems. However, that is not to say Kevin doesn’t embrace change, in fact he has a keen interest in concrete technology, helping Stevenson Concrete develop self-compacting, pervious, thermal and underwater concretes, along with a host of other specialised mixes.

If Kevin is known to grumble on occasions it is about the apparent lack of understanding amongst engineers of concrete’s properties. Outdated and incorrect specifications often make their way across Kevin’s desk, with more than a hint of ‘cut-and-paste’ about them. Educating the specifying community about appropriate concrete specification (and the NZRMCA Plant Audit Scheme) is an area Kevin would like to see more time and effort invested in, perhaps via the new consolidated association – Concrete NZ.

Throughout everyone’s career we are inspired and mentored by a few important individuals. Kevin is no different, with Lew Thomas and Gordon Carnegie providing invaluable advice and guidance on production, operations and sales.

Kevin’s long involvement with the NZRMCA has been built upon an appreciation of the Plant Audit Scheme as well as the relationships he has enjoyed with many interesting people. Attending conference (his first was in 1987 at Waitangi) and regional meetings allowed Kevin to meet industries stalwarts such as Bill Richardson, Maurie Hooper, Pat Philips, The Crammers, Noel Salter, Jerry Burke and Jim Begg.

Having been in this industry for many years Kevin has witnessed two serious economic downturns – 1988 and 2010. A particularly interesting period was the $100/m³ concrete war initiated by Stevenson in an attempt to bring the market into line and stimulate market growth.

His most rewarding projects have included the Farmers / Deka project in 1997, the Redoubt Road water tanks, the Auckland War Memorial Museum SCC beams, and more recently Ross Bannan’s ambitious residential ‘Grand Designs’. Kevin always gains an immense sense of satisfaction when a project was successfully completed.

There has been a host of strong long-term business connections build up over time with contractors and suppliers such as Golden Bay Cement, Holcim (New Zealand) Ltd, Aspec Construction, Macrennie Commercial Construction, G. Hadfield and many more, some of whom are no longer operating.

When Kevin retires in December to pursue more personal interests, namely golf, he will leave Stevenson Concrete, the NZRMCA and the ready mixed concrete industry better off for having been involved. Strong technical knowledge combined with excellent relationship skills (including with Bill, Philip and David of the Stevenson family) has seen Kevin earn the respect and admiration of many.

Kevin will finish his career at the same Penrose plant where it began.

Kevin has recently enjoyed working with Ross Bannan on several impressive residential projects.
2016 READY MIXED CONCRETE ASSOCIATION AWARDS

The 2016 NZRMCA Awards were presented recently at the New Zealand Concrete Industry Conference held at the Ellerslie Events Centre in Auckland. As with previous years the entries were outstanding and the winners exceptional.

PLANT AUDIT SCHEME SUPREME AWARD

ATLAS CONCRETE - TAKAPUNA PLANT

Quality assurance was the primary reason for the establishment of the NZRMCA and the development of the Plant Audit Scheme many decades ago.

The independent Scheme remains the cornerstone of the Association. The judging criteria for this Award acknowledge consistently high performance over an extended period of time.

In producing large quantities of concrete to a reliably high quality across a number of years Atlas Concrete’s Takapuna plant has demonstrated continuing excellence in performing to NZS 3104 Specification for Concrete Production.

The judges highlighted the fact that this plant had received Excellence Awards in each of the last 5 years, which is indicative of the attention to detail shown by the concrete production management team.

The plant is an example to all other ready mixed concrete producers across New Zealand.
CONCRETE INDUSTRY APPRENTICE OF THE YEAR

CARL HAY

Eastern Bay Concrete 2014 Ltd

Carl Hay of Eastern Bay Concrete 2014 Ltd in Opotiki took home the inaugural Concrete Industry Apprentice of the Year award at the New Zealand Concrete Industry Conference held at the Ellerslie Events Centre in Auckland, 6 to 8 October.

With a well-developed set of skills across concrete placing, finishing and construction, Carl describes himself as confident in his role, and as having a very good relationship with management and peers. His employer, Shane Clark, says, “Carl is an asset to the company and a positive sounding board.”

Carl’s BCITO training advisor, Scott Braithwaite, also had a few words of praise to add, “I admire Carl’s ever increasing thirst for knowledge which supports his impressive all-round practical skills.”

Carl is approaching the completion of his Building and Construction Industry Training Organisation (BCITO) National Certificate in Concrete Construction, after which he intends to enrol in the National Certificate in Concrete Production.

Cement & Concrete Association of New Zealand (CCANZ) Chief Executive Rob Gaimster points out that the construction industry is currently faced with a shortage of skilled workers, and having more people enrolling in BCITO qualifications is a key strategy in addressing this issue.

“As such, CCANZ and BCITO decided it was time to celebrate high achievers, along with those that offer their support, by establishing the Concrete Industry Apprentice of the Year award,” says Rob.

“The quality of the finalists was outstanding, covering those that work (and train) in precast concrete, placing and finishing, concrete production and concrete construction. To say the judges were impressed is an understatement.

“However, Carl stood out as a particularly worthy candidate who thoroughly deserved to be recognised for his technical competency in concrete construction, as well as his appetite to learn, and his leadership, communication and enterprise skills.

“I see the Concrete Industry Apprentice of the Year award going from strength-to-strength over the coming years. It will be a key component in celebrating excellence among our apprentices, recognising the importance of trade training and saluting employer and family support structures.

“Ultimately, the concrete industry offers a tremendous range of opportunities for those considering a construction trade. A perfect way to demonstrate commitment is to enrol in one of the BCITO’s concrete based National Certificates.”

The award was open to all those enrolled in, or who had recently completed, one of the following BCITO concrete based apprenticeships:

- Precast Concrete (Level 3)
- Concrete Production (Level 3)
- Product Manufacture: Pipe (Level 3)
- Product Manufacture: Masonry Product (Level 3)
- Construction: Sawing & Drilling (Level 3)
- Construction: Placing & Finishing (Level 3)
- Concrete Construction (Level 4)

The Concrete Industry Apprentice of the Year was made possible thanks to principal sponsors the BCITO and CCANZ.
TECHNICAL EXCELLENCE AWARD WINNER - FIRTH INDUSTRIES

Project  University of Canterbury Structural Engineering Laboratory
Client  University of Canterbury
Consultants  Inovo Projects Ltd
Aurecon
Holmes Consulting Group
Dominion Constructors Ltd

PROJECT SUMMARY
Challenging construction projects, coupled with a consultative construction methodology provide a real opportunity for a concrete supplier to develop innovative technical solutions. The University of Canterbury Structural Engineering Laboratory strong floor/wall is an example of such an opportunity.

The challenges for Dominion Constructers were considerable. Extremely congested reinforcement, high strengths, tight tolerances (+/-2mm), significant depth (2m) and large pours were just a few of the obstacles that required innovative concrete solutions in order to be overcome.

A series of three concrete mixes were formulated and trialled which were designed to be supplied in one continuous operation of 970m³. The lowest layer being a self-consolidating concrete designed to cover the first 300mm of the pour, in a zone of considerable congestion where traditional vibration was impractical. In addition to the rheological properties, the mix needed to be able to be delivered in short cycles, in large volumes and remain open for layer 2.

Layer 2, the bulk of the 2m pour; needed to minimise heat of hydration, achieve compressive strength of 40MPa, be workable and pumpable, and allow placing teams to work quickly. It also had to remain open for layer 3.

Layer 3, the upper 300mm, had to achieve high strength (65MPa), be compatible with the previous concretes, be pumpable in great volumes (a challenge for high strength mixes), and have sufficient bleed to accommodate the challenging placing conditions of Christchurch in spring.

Technical innovation was also required in providing advice on the construction methodology. Models were developed to predict the likely temperature rise in the three layered system, what type of curing would be best, whether insulation was required, and when insulation could be removed.

A critical success measure was that the crushing strength of the concrete around the numerous inserts had to be greater than the shear capacity of the bolt inserts. The contractor developed a solution to maximise the sleeve diameter; however finite element modelling (verified through full scale test blocks) still demonstrated that 65MPa concrete was required. It was imperative that the shear tests were conducted at a time when the concrete had reached the desired strength. This involved monitoring of the temperature of the concrete, using temperature matched curing for test cylinders, and developing a maturity model to predict when would be the most appropriate time to test the concrete cylinders.

Further technical excellence was offered by the construction of the walls. The reinforcement was very congested, and high strength concrete was needed around the inserts. However, the option did not exist for the three layer solution. The challenge for Firth was to develop a concrete mix which would keep temperatures below a maximum, but achieve the greatest possible strength. Heat of hydration models were developed, calibrated against the floor, modified to accommodate different boundary conditions, and then a suite of concrete solutions modelled. The chosen solution was trialled to confirm the thermal performance and the desired hierarchy of bolt failure.
EXTRA DISTANCE AWARD WINNER - ALLIED CONCRETE

Project          Curvev Basin Chairlift & Remarkables
                 Ski Field Base Building
Client           NZSki
Consultants      Aurecon
                 Leitner Poma
Contractors      Arrow International

PROJECT SUMMARY
Over two years in the off season, Allied Concrete supplied over 2,900m³ of concrete for the new Curvev Basin Chairlift and Remarkables Ski Field Base Building.

The majority of the concrete supplied was a 30MPa 6% air entrained mix to deal with the freeze thaw conditions, and with an hour travel time was retarded.

It was a 50 kilometre round trip, with the last 13 kilometres a steep climb on an unsealed road to the existing Base Building. Access up the mountain was up an even steeper 1.6 kilometre climb on a ‘Cat Track’.

Stage 1 involved supplying concrete for 12 tower bases and two return stations on the new chair lift. Both return stations required around 75m³ of concrete in one pour. With the top station over 1,900m above sea level it could only be supplied in 3.5m³ loads due to the steep gradient of the access road. 6m³ loads were taken as far as the Base Building where they were then transferred into smaller trucks to access the top of the mountain. All the towers were accessed by truck on the mountain taking up to 20m³ per tower again in maximum 3.5m³ loads.

Stage 2 involved supplying 2,400m³ concrete for a new Base Building (1,600m² above sea level) at the Remarkables Ski Field over a 6 month period. The biggest pours where around 100m³, but the main hurdle faced on Stage 2 of this project was the weather:

Once the Remarkables Ski Field had closed at the end of the 2014 season and excavations had begun for the new Base Building the mountain was hit by frequent weather systems that included numerous snow days. During the last month of the project winds regularly reached up to 150kph. In total, 42 days were lost to inclement weather on the project.

There were at least four occasions when trucks were lowered off the mountain tethered to a 17 tonne loader equipped with a full set of ice breaker chains.

During the last month of the project Allied Concrete Queenstown was required to work 21 days straight to complete this project as there was a real danger that the Base Building would not be finished for the new season, meaning the ski field would have remained closed for the 2015 season.

This required careful management of staffing levels to not only supply the project but also maintain supply to other customers over a very busy period. Compliance with all heavy license restrictions, driver hours and days off were also non-negotiable.

Another issue that caused problems over both stages of the project was the deterioration of the ski field access road. High volumes of heavy vehicles throughout the build caused massive corrugations in the road which on the return trip with an empty truck led to a number of issues with the fleet.
Curvey Basin Chairlift and Remarkables Ski Field Base Building
PERFORMANCE SPECIFICATION GUIDELINES FOR THE SUPPLY OF READYMIXED CONCRETE IN NEW ZEALAND

JAMES MACKECHNIE

Specifications for the supply of concrete to construction projects tend to have a combination of prescriptive and performance-based criteria. Prescriptive elements in specifications are simple to achieve but sometimes these requirements are in direct conflict with the stated performance required for the project.

Internationally there is a movement towards performance-based specifications whereas locally some structural designers appear to favour prescriptive-based approach where recipes need to be followed or specific materials included in concrete mixes such as chemical admixtures or additives. This prescriptive approach provides less flexibility for concrete suppliers to optimise concrete mixes and may in fact be counter-productive in some cases. Using a performance-based approach to specifying concrete has many benefits but must be well managed to ensure overall structural performance and serviceability are achieved.

Prescriptive specifications are often seen as the safest option by structural engineers as they are not familiar with performance-based techniques and rely on older approaches that may have worked in the past. Examples of current specifications clauses that are in direct conflict with modern principles of concrete technology include the following:

- Specifying low slump targets and tolerances that will severely reduce rate of delivery of concrete or are impossible to achieve.
- Restricting the use of chemical admixtures such as super-plasticisers due to problems using these materials many years ago when the technology was being developed.
- Specifying maximum water/cement ratios in the mistaken belief that this controls shrinkage and by association will reduce the risk of cracking.
- Limiting the drying shrinkage of concrete to very low values despite the structure being relatively massive such as raft slabs where limited drying is possible.
- Specifying minimum cement contents for waterproof or high durability concrete rather than considering appropriate performance requirements.

Many specifications used in construction require updating and structural engineers could do well to update their knowledge of concrete technology. Figure 1 shows a basic microstructural model of concrete, which when properly understood should help improve concrete specifications. Contractors and concrete suppliers often find the following issues when dealing with concrete specifications currently being used in New Zealand:

- Slump is not a direct measure of workability and practical slump targets need to be set to ensure placing and compaction of concrete is not compromised on site.
- When specifying a grade of concrete it is not necessary to prescribe minimum cement contents or maximum water/cement ratios as these are often in conflict with the strength used to design the structure.
- Specifying a drying shrinkage limit is only necessary for shrinkage sensitive structures such as bridge decks and toppings and should not be considered as a predictor of cracking risk.
- There are a range of durability tests that can be used to measure the resistance of the cover concrete to carbonation or chloride ingress and these need to be carefully considered in terms of speed of measurement, reliability and cost.
- Implementing performance-based specifications needs an understanding of the overall framework so that testing is targeted correctly, limits are achievable and there is some allowance for variability.

Performance based specifications target the required outcome and allow contractors and concrete suppliers to achieve this without...
prescribing materials or mix design details. The difference in approach is illustrated in Figure 2 and it should be stressed that many projects require only limited performance targets such as strength. Using a hybrid specification with some prescriptive and some performance limits is also widely done and is not problematic if prescriptive requirements are practical.

Many larger infrastructure projects have defined performance requirements and achievement of these cannot be assumed but needs to form part of the quality assurance of the contract. Any framework for establishing performance criteria needs to consider the following:

- Robust quality control tests that can be routinely carried out by laboratory technicians and have both reliability and repeatability as found in cylinder strength testing.

- Service life model that is able to relate service performance to the quality control test being used for the concrete.

- Allowance for variability and also for difference that are possible between material potential and as built values to allow for construction effects.

Understanding the performance of concrete could be improved by agreeing on appropriate methods and developing more local data (see Figure 3). This research would then allow for the following:

- Comparing the performance of alternative binders that potentially could be used in New Zealand in the future.

- Proving equivalence such as in the debate about the inherent durability of precast concrete where no wet curing may be applied after initial accelerated curing in the case where a higher strength grade was used compared with that specified.

- Optimising concrete mixes for sustainability reasons without compromising other properties such as durability.

This article is based on the paper Moving Towards Model Specification Guidelines for the Supply of Readymixed Concrete in New Zealand, by James Mackechnie, presented at the 2015 New Zealand Concrete Conference in Rotorua.

James Mackechnie presented a follow-up paper Fresh Concrete Performance Guidelines for Construction Projects in New Zealand at the October 2016 New Zealand Concrete Conference in Auckland. A summary article based on that paper will feature in an upcoming issue of the NZRMCA Newsletter.
**KEY DATES**

**NZRMCA REGIONAL MEETINGS** (check local notices for confirmed dates and precise times)

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<td>Northland</td>
<td>Thursday, 1-2 December 2016</td>
<td>Far North (plus fishing)</td>
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<td>South Island</td>
<td>Tuesday, 21 February 2017</td>
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**NZRMCA NATIONAL COUNCIL MEETINGS**

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<td>Council</td>
<td>Tuesday, 28 February 2017</td>
<td>1.00 p.m. to 5.00 p.m.</td>
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<td>Joint NI</td>
<td>Wednesday, 1 March 2017</td>
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**FUN (CONCRETE) FACT**

**MODULAR HOUSING IN THE PIPELINE**

The inspiration for prefabricated, modular houses can come from a variety of sources – including sewage pipes. Portuguese architect Samuel Gonçalves and his studio at the Science and Technology Park of University of Porto recently adapted massive concrete drainage pipes for use as modular homes to address the housing crisis in Portugal.

The Gomos System, currently on display at the Venice Architectural Biennale, takes standard pipes used in drainage infrastructure and installs them side by side to create the basic shell – floor, roof, and two of the four walls – of a home. As the pieces are based on an existing form, they can be easily modified, manufactured, and moved.

While the component parts are fabricated in a factory over three months, it takes only three days to construct the house, which can be fashioned by combining two or more segments. The finished product is covered in slate and timber and can either have a mono-pitched or gabled roof.

The global housing deficit can be measured in the scale of billions. Two opposite approaches can be seen tackling this issue of such magnitude and scale: an inefficient approach and an efficient approach. An inefficient construction system is labor intensive, and this means that, from a political point of view, using as large a work force as possible will keep unemployment rates low, which is just as important as reducing the housing shortage. At the same time, there will be a need for approaches using very efficient prefabricated constructions able to respond quickly and accountable in terms of technical quality to an ever increasing housing demand. – Samuel Gonçalves.

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