

concrete

Volume 49 Issue No. 3 September 2005

Concrete construction for better performing hospitals

*The design and construction of hospitals can have a significant impact, not only on the day-to-day running of the facility, but also on the recovery of patients. A new report from The Concrete Centre, titled **High Performance Hospitals using Concrete Frames and Cladding**, outlines the UK experience with the construction of hospitals and identifies that construction in concrete offers many advantages.*

Good hospital design can provide an improved working environment for staff and recovering environment for patients. The British Government has a major initiative underway to provide 100 new hospital buildings by 2010. That commitment makes it essential to ensure that the design and construction process not only improves the function, value and whole-life performance of each facility, but also allows increased value. The UK Concrete Centre has studied hospital construction and has identified many benefits of constructing hospitals in concrete which also have relevance in New Zealand.

A typical list of needs for a hospital facility include:

- Value/cost - how well it performs and its function
- Speed - how quickly it can be brought into use
- Flexibility
- Sustainability issues - both during construction and in use
- Vibration
- Services - often the most expensive and slowest element to construct
- Partition walls - installing and sealing to the frame
- Fire resistance.

Construction in concrete was found to be the best solution for this diverse list of needs.

Vibration Control

Vibration control is important in areas such as operating theatres and night wards. Concrete can easily provide high levels of vibration control often without the need for significantly thicker floor slabs. Research conducted by Arup, 2004, entitled *Hospital floor vibration study: comparison of possible floor structures with respect to NHS vibration criteria*, has provided new insight into the additional mass required to upgrade the vibration performance of an office floor to that required by the National Health Service (NHS). The results of the study are shown in figure 1.

In addition to the cost benefits, design and building teams recognised that construction in concrete avoids the risks, often associated with other materials, of having to seek modifications to satisfy the NHS vibration criteria.

Services

The Concrete Centre's research has shown that the choice of material and the design of a building frame and cladding can have a surprisingly influential role on the services which are generally the most critical elements in construction, cost and time. Concrete flat slabs were found to be ideal for highly serviced areas such as operating theatres and intensive care units. They allow complete freedom to prefabricate, install and maintain services without having to thread ducts

under or through intrusive down stand beams. Healthcare methods, IT provision and equipment are continually changing, therefore for hospitals, flexibility of use is a major design requirement. The ability of concrete construction to be adapted at a later date is a significant benefit.

Construction with concrete can also reduce both the capital and running costs of air conditioning. The use of fabric energy storage allows for greater passive cooling and heating of the building.

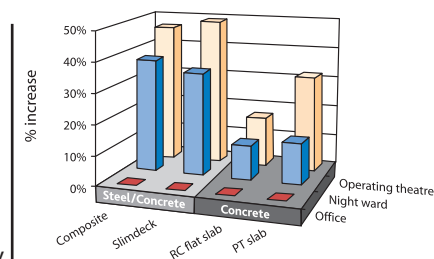
Partitions

An additional benefit of floors with flat soffits was the reduced cost of sealing partitions. Hospitals require kilometres of partition walls, which may need to be sealed to prevent airborne cross-contamination.

More information

High Performance Hospitals and *Hospital floor vibration study: comparison of possible floor structures with respect to NHS vibration criteria* are available free for download from www.concretecentre.com.

Vibration control: Increase in floor thickness



Vibration control: Increase in total mass

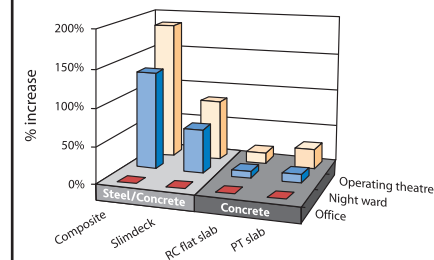


Figure 1. Image courtesy of the Concrete Centre.

Upfront...



Patrick McGuire,
CEO.

Since taking up the position of Chief Executive at CCANZ in July, I have discovered that my original impression of the Association as an efficient, effective and well-managed organisation has been borne out. I have been impressed by the energy and commitment of our staff and I'm looking forward to grappling with the ever-changing dynamics of the industry in New Zealand.

Accepting the new role and moving from Sydney to Wellington was an easy decision for me. After 11 years of running an Australasian "product based" industry association, I was ready to take the next step and find a position that could expand on my current skills and that would let me face new challenges. The position at CCANZ combined all of these elements and it was a great opportunity both in terms of career and lifestyle.

One key facet that I'm particularly excited about is that the New Zealand building and construction industry is in a state of continuing change. I see this as a strength that will provide CCANZ with many opportunities in the years ahead.

The 2005-06 Integrated Business Plan has just been adopted by the CCANZ Board and there are a number of issues that we will be addressing over the coming year. Although cyclic in nature, our industry is only going to continue to grow and mature, and I see the development and implementation of the new Building Regulations as a strong challenge facing the Association. We will be focusing on further supporting the industry in this review process, as we have done in the past, and continuing our goal of being the integrated and leading voice in our sector. This will require us to work towards establishing new strategic relationships, while ensuring that we strengthen our existing ones.

CCANZ will also be looking to address other industry issues including standardisation, environmental risks and the overall sustainability of our industry. We also aim to further educate and build on the skills of those in our industry by providing continued research and training to the sector.

My passion for the industry is great and I will be working with our team to ensure that we continue to deliver knowledge and expertise to the industry. I look forward to the changes and the challenges ahead, and getting to know you all in the years to come.

Engineering post the World Trade Centre collapse

After three years of research and costs of approximately NZ\$27 million, the 10,000 page report on the World Trade Centre collapse is complete and being debated by engineers around the world. The report, prepared by the United States National Institute for Standards and Technology (NIST), makes for some sombre reading when put into a New Zealand context. Three of the main conclusions of the report are:

- Buildings should be designed to ensure that an uncontrolled fire could burn out without causing structural collapse
- Buildings should be designed to prevent progressive collapse
- The report rules out the need to specifically design for aircraft impact.

It is interesting to note that independently the Institute of Structural Engineers in the United Kingdom recommended in July 2002, that all buildings should be designed to survive complete burnout, including robust, resilient and durable fire protection.

The obvious question for New Zealand engineers and policy analysts is 'when will a review of New Zealand fire performance requirements commence to ensure that they are consistent with international thinking?' The industry needs to evaluate whether modern New Zealand buildings are able to remain standing in an uncontrolled fire, and what the cost implications are, if any, in achieving this. Until industry experts work together



The new Freedom Tower, New York. Image courtesy NCE.

and discuss this, New Zealand is very out of sync with international practice and thinking.

The building code and fire design in New Zealand is focused on performance based design. However, the NIST report is clearly more sceptical of the merit of performance based fire engineering than the policy makers here in New Zealand are. The NIST report recommended that:

- No further use of performance based fire design is conducted until more research is completed
- All elements should have the same prescribed fire resistance rating
- At present beams are often provided with half the fire resistance rating of the columns.

Effectively the performance based fire engineering techniques pioneered in Europe and adopted here in New Zealand have been given the thumbs down by NIST. The Department of Building and Housing needs to act urgently to review the NIST report to evaluate the implication for safe fire design and construction in New Zealand. At a cost of NZ\$27 million, it is reasonable to assume that the recommendations of the NIST have been well researched and considered.

The magnitude of the implications of these recommendations by the NIST concerning the design of multi-storey structures can be illustrated by reviewing the concept for the “Freedom Tower” which is a proposed replacement of the World Trade Centre. The Freedom Tower allows for:

- Simultaneous evacuation of all floors
- Maximum remoteness of escape stair wells
- A high strength concrete core with walls up to 900mm thick
- Fire protection on all steel members which is five times the current New York code requirements.

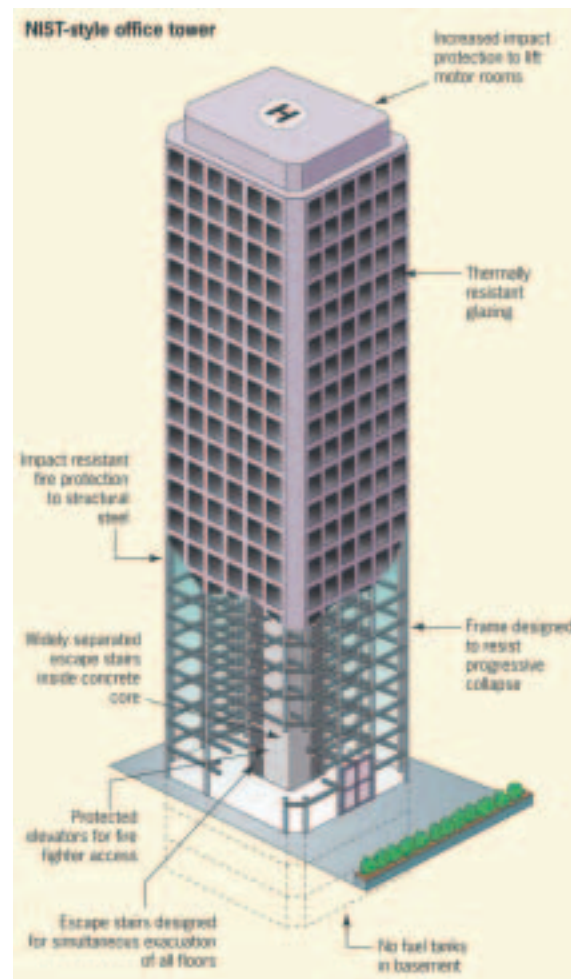
The secret to the design according to designers is “lots of system redundancy.” The tower will include:

- Two sprinkler standpipe risers within the core with alternate take off at the floors to minimise loss of function if one of the risers is out of action
- Water storage that will be dispersed throughout the core
- Closer sprinkler spacing and higher rate of flow with a 60 minute rather than 30 minute supply capacity.

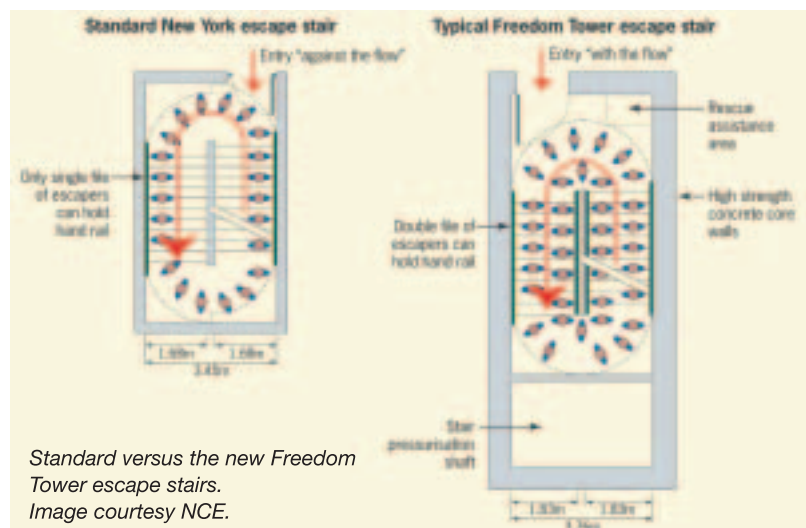
The report from NIST indicates that New Zealand’s philosophy to fire engineering is contrary to the direction being taken by other developed countries subsequent to the collapse of the World Trade Centre. Surely when this is the case, the prudent approach would be to review the direction in which New Zealand is heading. It’s time

to evaluate the implications that the NIST report will have on design and construction within New Zealand.

Comments made within the June issue of New Civil Engineer magazine are standing testament to the importance of the NIST recommendations and their practice: “The recommendations are tough and will no doubt be considered by many in the profession, at times, as a step too far. But we need to heed them to ensure the world’s concept of what is ‘unthinkable’ is never experienced again.”



The recommended NIST style tower. Image courtesy NCE.



Standard versus the new Freedom Tower escape stairs. Image courtesy NCE.

Cook's Clinic... Spring - the concrete cracking season

Spring is always welcome after a cold wet winter. However, it represents one of the most challenging periods for concrete placement, when increased diligence from placers, builders, and specifiers is essential.

The two most prevalent forms of random cracking in spring are plastic shrinkage cracking and restrained early thermal contraction. This article discusses these crack types and how to reduce the risk of them occurring.

Plastic shrinkage cracking

Plastic shrinkage cracks form before concrete hardens because the top surface has prematurely dried. The cracks are wide, closely spaced and random in direction. The highest risk weather for plastic shrinkage cracking is sunny, or windy days with low humidity levels.

After concrete has been placed, vibrated, screeded and floated, it is left so the bleed water can rise to the surface. The slab cannot be finished until it is hard and the bleed water has evaporated. The bleed water will appear within 15 minutes of placing and the slab is ready for finishing after several hours, depending on the concrete temperature. If the top surface is allowed to dry before final finishing, then plastic shrinkage cracking may occur. The risk of plastic shrinkage occurring is greatest when:

- The temperature difference between the concrete and air temperature is large. In spring, this type of cracking can occur in an area exposed to the sun, while shaded concrete remains uncracked. Concrete exposed to the sun can be significantly hotter than the air temperature
- Low bleed concrete mixes (e.g. superplasticised mixes and/or mixes with high quantities of ultrafines) are used. The more concrete bleeds, the less likely it is that the surface will prematurely dry out. Conversely, greater precautions are required when using low bleed concrete mixes
- Low humidity days
- High wind speeds.

Information Bulletin IB73, available for free download at www.cca.org.nz, provides a graph for calculating the probable evaporation rate from the surface of the concrete. When the calculated evaporation rate exceeds 0.5kg/m²/hr for low bleed concrete mixes

and 1.0kg/m²/hr for high bleed, there is a high risk of plastic cracking.

The following options can be taken if there is a risk of plastic cracking:

- Use a proprietary evaporation retardant spray. These are inexpensive and provide a good degree of protection if used in accordance with the manufacturers instructions
- Provide a fog mist spray to increase humidity above the concrete. It is important water is not added to the surface
- Use polypropylene fibres in the mix.

Some simple precautions, such as effective early curing, can ensure that these forms of cracking can be controlled.

Restrained early thermal contraction

Sometimes concrete can appear to have shrinkage cracks, even though the slab has a sensible arrangement of saw cuts. If confronted with this, find the concrete temperature when the slab was placed, and the temperature it dropped to overnight after the pour. It is likely that the slab has cracked due to restrained early thermal contraction.

Concrete, like any material, contracts when it cools. So if the ambient temperature plummets, your newly poured slab will contract. Tensile strains will develop in the slab if it is built in, or friction can develop along the base. The ability of concrete to withstand tensile strains is typically at a low point when it is approximately 6-18 hours old at low night time temperatures. If the drop in temperature is sufficient, estimated at 13°C, the concrete may crack. Often the cracks are hairline and overlooked when the saw cutter comes to cut the slab. However, they open up as drying shrinkage occurs.

There are many options to prevent this cracking:

- Avoid pouring when you expect day/night temperature differences to exceed 13°C
- Used tooled joints, crack inducers, or early entry saws to ensure that the joints are in place before the placer leaves the project. This should result in the joints opening up rather than the slab cracking when it contracts overnight
- Insulate the slab overnight
- Careful curing (avoid curing with cool water).

International News...

Designer concrete art pavers

A central Tasmanian street has been transformed into an attractive and eye-catching work of art thanks to the remarkable versatility of concrete.

When the Hobart City Council (HCC) decided to rejuvenate the cultural character of Elizabeth St in North Hobart, they asked Tasmanian artists to submit ideas. The Council's brief was "to design and manufacture a bespoke segmental paver series to act as unifying sub-elements across the kilometre length of the project."

The winning company, Watermark, responded to the design brief in an imaginative and thorough way. The company has two decades experience in pottery and consequently viewed the commission as a unique opportunity to embrace a completely new construction medium.

Watermark's approach was to "address the physical and metaphoric communal link created by the footpath, focusing on the connective nature of a journey through the community. Both geometry and pattern were employed to create a sustaining contemporary design, unifying the pavement with existing as well as future art works. The uniformity and proximity of the laid pavers is intended to aid the notion of a journey, with the device of pattern providing both movement and interest. The artistic design draws the viewer along the entire span of the artwork with an evolving journey expressed by changes in colour, texture, shape and scale."

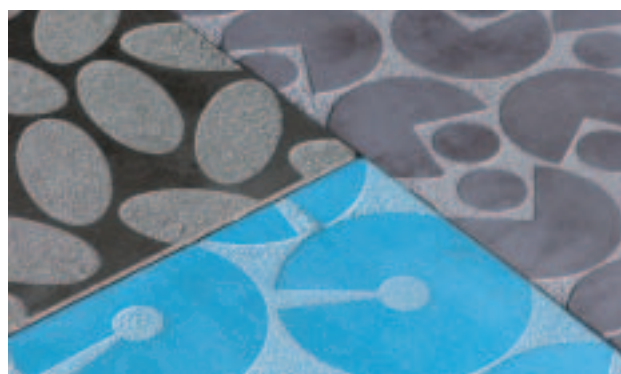
Peter Battaglone of Watermark researched a number of material options for the pavers. Concrete emerged as the obvious choice due to its incredible resistance to wear. The durability of concrete against the aging effects of water, temperature and time would allow the artwork to be enjoyed by local Tasmanians and visitors to the city for many years to come.

Concrete also offered the added benefit of a broad palette of colour options. After sourcing the raw concrete material for the project, various pigment colours were extensively trialled. Combinations of sand and aggregate, along with curing and sandblasting practices, were tested.

Once these tests had been conducted, 20 precasting moulds were produced by a local plastic fabricating business, Eagle Plastics. A proprietary release agent ensured the moulds performed perfectly to produce the 1,200 concrete pavers required for the project.

The 60-MPa compressive strength pavers were cast in two layers. Next, a structural 500mm thick backing layer was produced which incorporated cement, Bluestone (a type of granite), coarse aggregate and sand. The decorative wear surface was then cast against the plastic structural layer incorporating four vivid colours - Cathy Pigments Australasia's Byron Blue, Blood Red, Uluru Red, Black and Jade Green. An off-white colour, titled Brighton Lite cement and white quartzite sand were employed to uphold consistency of colour and tone.

This step was followed by steel-trowel burnishing for



Designer concrete pavers, Elizabeth Street, North Hobart. Images courtesy of Watermark Pottery.

twenty one days. Water curing was then utilised to ensure the highest abrasion resistance and durability.

In order to achieve the intricate sandblasted pattern on the pavers, Watermark used masking stencils. This process was used firstly on a commercial concrete paver, to provide the background palette. To add interest and allow the pavers to capture the moonlight and sunlight, they were then placed in a staggered formation. This also reinforced the feeling of a journey, as the viewers eye is drawn along the pathway.

The final pavement profile consisted of 65mm thick pavers, bedded on 20mm of metal dust, 30mm asphaltic concrete seal and 150mm compacted fine crushed rock as a sub-base over the existing profile.

The Elizabeth Street project has paved the way for concrete and its successful use in the city street environment. Watermark attributes the project to comprehensive preliminary research and the motivation and enthusiasm of their employees for the designer pavers. The final result is an original and appealing streetscape that is a standing testament to the versatility, durability and attractiveness of concrete.

News...

Holcim Awards for Sustainable Construction

Five New Zealand projects are amongst 255 entries received from Asia Pacific countries for the Holcim Global Sustainable Construction Awards. Organised by Switzerland-based Holcim Foundation for Sustainable Construction, the awards have attracted more than 1,500 entries from 118 countries. The awards recognise contributions to sustainable construction - regardless of scale - in architecture, landscape architecture, urban design, civil and mechanical engineering, and related disciplines.

Members of the Board of the Holcim Foundation for Sustainable Construction said they had been astonished at the strong response to the competition, with entries received from architects, engineers, students and developers. The awards will be judged at two levels; the ceremony for the Asia-Pacific region will be held in Beijing in September, and a global phase for the best entries from each region will be held in 2006.

Sika purchases Fosroc

Swiss specialty chemicals company, Sika NZ Limited has signed an agreement to purchase the business of Fosroc NZ Limited. The acquisition is part of an ongoing growth strategy for the Sika Group and is expected to generate annual sales in excess of NZ\$45 million.



The SikaFloorSystem being applied. Image courtesy of Sika NZ Ltd.

In New Zealand, Sika makes speciality admixtures for ready mixed concrete and Fosroc makes construction sealants and adhesives. There will be no change

to the existing product ranges and the two brands will continue to be represented.

Sika NZ supplies products to the construction, marine, automotive and transportation industries and expects to take over the New Zealand operation of Fosroc on 1 September 2005.

Pacific Steel extends product range

Pacific Steel will extend its range of products at the end of 2005, from the current Micro-Alloying process (MA) to include reinforcing steel produced via the Quench and Tempered (QT) process. Though QT products have been available from other sources, Pacific Steel says this will enable the company to reinforce the industry's confidence in supply. That means the high quality and clearly identified Seismic® reinforcing bars can be specified where seismic performance is demanded. All products comply fully with the New Zealand standard, NZS 4671.

Large foundation for Ezibuy

Ezibuy are in the process of developing one of the largest distribution centres in New Zealand and have just finished laying the 24,000 square-metre concrete foundation for its centre in Palmerston North. Substantial growth over the past five years has meant that Ezibuy's four existing distribution centres are unable to cope with current demand. The new centre will bring all distribution for the company under one roof again.

The concrete component of the project is expected to take three months, as it requires eight segments of floor sections to be filled, one at a time. The first section took approximately 96m³ of concrete to fill, and concrete was brought in from as far afield as Fielding.



Students build giant concrete tuatara

Students at Kimbolton School in the Manawatu are currently building a 12 metre long x 1.5 metre high cement and sand tuatara with seats for their school playground.

The volunteer project for IPENZ is being managed by Opus and aims at encouraging young people to get involved in engineering.

The project is currently in the timber framing and wrapping with chicken wire stage, and students will soon get the opportunity to help in the plastering and concreting stage. It is due for completion in September.

Concrete Institute of Australia - 22nd Biennial Conference

Concrete 05 will be held in Melbourne, Australia from 17-19 October.

The overall theme of the Conference is *Issues, Opportunities and Innovations*. The programme will feature International and Australian speakers who will provide opportunities to explore issues in design and detailing, construction techniques, new products and reporting new research.

For more information or to register, visit www.coninst.com.au or email concrete2005@meetingplanners.com.au.

People...

New CEO for Building Research



Sunil Vather, new CEO of Building Research

Sunil Vather has been appointed as the new Chief Executive Officer of Building Research.

Sunil comes to the role from Industrial Research Ltd, where he held the position of General Manager of Science Strategy and prior to that, General Manager of Operations at the company. He was an employee of Industrial Research Ltd for twelve years.

Sunil has firm goals for the future of Building Research. He wants to identify key factors that will affect New Zealand's built environment and the building and construction industry.

Sunil is looking forward to taking on his new role and proactively meeting the needs and expectations of all those affected by the built environment, while acknowledging that the industry will face a few challenges with current issues such as the Kyoto Protocol, urbanisation and New Zealand's aging population. He will seek to study how the built environment transforms and adapts to our ever-changing world.

Sunil will take up his new role on the 29th August 2005.

New CEO for RMBF

The CEO of the Registered Master Builders Federation (RMBF) Chris Preston is retiring and the current CEO of



Pieter Burghout, new CEO of RMBF

the Building and Construction Industry Training Organisation (BCITO), Pieter Burghout has been appointed the new CEO of RMBF.

Preston is retiring to pursue family and business interests in the South Island, however will still be actively involved in the Federation, having been appointed to the Board of Directors of Master Build Services (MBS) for a three year term.

Chairman of the Board of Directors, Kevin Stanley, says Preston has played a major role in the growth and development of the Federation over the past five years. The board believes that he leaves the organisation in a strong financial position, highly regarded by members, business partners and industry colleagues and well positioned for future growth and development.

The Board of Directors is looking forward to working with new CEO, Pieter Burghout, who will bring a wealth of sector experience to the position and will be the ideal person to lead RMBF on the next phase of growing the business of members and their leadership role in the sector.

Pieter Burghout will take up the RMBF CEO position on 1 September. Chris Preston will be working for the Federation until December to ensure a smooth transition and to complete some key on-going projects.

Building Act Update

The new Building Act 2004 requires that restricted work be conducted by a Licensed Building Practitioner (LBP). The Department of Building and Housing (DBH) consulted earlier this year with industry to define its categories of LBP, and has decided on the following licence classes:

- Design - 3 categories
- Building Site Supervision - 3 categories
- Carpentry
- External Plaster Systems
- Roofing
- Brick and Blocklaying
- Structural Concrete & Steel Construction Supervision
- Specialist Facades.

The next stage will be to determine how a person can demonstrate that they have the appropriate skills and competencies to be classed as a LBP in one of the above classes. The DBH is forming working

parties to advise on the appropriate standards and assessment frameworks for each of these licence classes. CCANZ will be represented on the design, site supervision, plaster, blocklaying, and structural concrete workgroups.

Public comment on a consultation document on Building Product Certification closed on 16 August. This is the first round of consultation on this topic, so the details are vague at the moment. It is unclear whether the certification applies to an individual product, such as a masonry block, or a system such as a wall. Product certification should be of interest to manufacturers supplying products to the construction industry. A product certificate is a method of demonstrating compliance with the performance requirements of the Building Code.

CCANZ's submission on the Building Product Certification document can be downloaded from our website www.cca.org.nz.

NEWS from the ASSOCIATIONS

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2005 DIARY:

September

- 8 PCNZ Executive Meeting
- 22 CCANZ AGM, Auckland
- 22 - 24 NZ Concrete Industry Conference, Auckland
- 23 NZRMCA AGM, Auckland
PCNZ AGM, Auckland

November

- 8 NZRMCA Meeting, Wellington
- 24 PCNZ Executive Meeting, Auckland

December

- 6 CCANZ Board Meeting, Wellington

NZMCPA 2005 Conference

NZMCPA

The NZMCPA 2005 Conference was held on 8-9 July in the Hawkes Bay. The conference was a huge success and provided great entertainment, especially with the debate between the NZRMCA Technical Staff and Concrete Placers arguing the topic "How concrete doesn't crack." Next year's conference debate topic will be "Women shouldn't be in concrete."

Over 70 people attended the NZMCPA Conference and numbers look set to exceed that next year, with NZMCPA membership continuing to grow.

Precast Plant – Site visits, August 2005

PCNZ

Busck Prestressed Concrete and Stahlton Prestressed Concrete have organised a day of site visits for major Auckland contractors and suppliers. The visits aimed to provide project engineers, site managers, engineers and foreman with a better understanding of the manufacturing process for precast concrete, from shop drawing to finished product. Precast NZ intends to continue their programme of site visits to other specialist plants in the future, where both contractors and specifiers will be invited to attend. Specifiers or contractors interested in participating in site visits should contact Precast NZ at 09 638-9416.

NPCAA Visit - PCNZ meeting Christchurch 21 July 2005

PCNZ

Members of the National Precast Concrete Association of Australia and Precast New Zealand met in Christchurch, following their respective board meetings, to discuss common trans-Tasman issues. It was then followed by an evening dinner and concluded with site visits the following day. Sarah Moore, Executive Officer at NPCAA and Alan Kirby, CCANZ, combined to organise a successful series of meetings.

BCITO – Industry Trade Training (National Certificate in Concrete Construction - Precast Concrete)

PCNZ

Precast NZ encourages members to participate in the BCITO trade training programmes. Current registered training agreements for the BCITO's Precast qualification at 30 July 2005 are:

Northern Region – 11, Waikato/BOP – 8, Central North Island – 3 (2 completed 2005), Wellington – nil, Central South Island – 14, Southern – 7 (2 completed 2005)

Total – 43 trainees

NZCS Study Fellowship

NZCS

The New Zealand Concrete Society Study Fellowship has been awarded to Dion Marriott, a PhD student at the University of Canterbury. Dion's thesis research examines the use of supplementary advanced materials and supplementary damping devices in the retrofit and new design of reinforced concrete buildings subject to seismic loads.

NZCS AGM

NZCS

The NZCS AGM will be held during The Concrete Conference at the Auckland Convention Centre, on Thursday 22 September from 5.00–5.45 pm. The Society is looking for new Councillors so the Council can represent as broad a spectrum of the industry as possible. Members are asked to consider suitable candidates for election. To find out more information about the nomination process or other Council information please contact Vice President Paul Wymer.

NZ Concrete Industry Conference 2005

The 4th combined New Zealand Concrete Industry Conference will be held at Skycity Convention Centre in Auckland from 22-24 September. The conference aims to improve communication between industry sectors, highlight key issues and trends within the New Zealand and international building and construction industry, and provides the opportunity to bring together a forum to represent a strong voice to the public and local and central government.

For further information or to register, phone (09) 536-5410, email concrete@bluepacificevents.com, or visit www.theconcretecentre.co.nz.