


concrete

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Fabric Energy Storage - Energy Efficiency in Commercial Structures

By Chris Munn, CCANZ

The energy efficiencies offered by concrete based materials are well known when applied to residential housing. There has been extensive research to model the performance of these high mass structures under New Zealand environmental conditions, and these results have been well reported in the literature.

There have been fewer examples of high mass construction techniques being used in the commercial sector in New Zealand. The most often quoted example is the Maths and Science Building at Canterbury University. This has been the subject of ongoing research and several papers.

Overseas, the story is different. There are many examples of high mass structures being used to produce thermally efficient, comfortable work environments.

How does fabric energy storage work?

Concrete walls, columns and floors have a large capacity to store and release heat. This function has the effect of regulating the internal environment, by reducing and delaying the onset of peak temperatures. This effect is referred to in New Zealand as the thermal mass advantage. Overseas, the technique of utilizing the advantages of high mass in commercial structures is referred to as “Fabric Energy Storage”, or “FES”.

This technique has been widely used overseas for commercial offices to create comfortable working environments for the occupants, and reduced energy consumption costs for the owner/occupiers.

Why use FES?

The operational costs of heating, ventilation, air-conditioning and lighting are substantial. In the United Kingdom demand for air conditioning has been increasing simply to maintain thermal comfort. A developing trend in offices has been a substantial increase in cooling requirements brought about by the increasing use of computers, printers, photocopiers etc., together with uncontrolled solar gain.

UK experience points to a significant increase in power usage for the refrigeration plant, pumps and fans

An example of high mass construction - the Maths and Science Building at Canterbury University.

necessary to maintain this “comfortable” environment. The energy consumed by these plants is second only to the energy used for lighting. Of more concern is the fact that this portion of energy consumption is the fastest growing sector in the commercial/services market.

This growth has been occurring at a time of increasing awareness of issues such as global warming, greenhouse gas emissions and climate change.

Not included in any of these costs, are the substantial costs associated with the purchase and installation of air conditioning/heating plants, together with the ongoing maintenance costs over the life of the structure.

As a consequence of these environmental pressures, overseas designers are searching for innovative means of achieving a comfortable working environment. The thermal storage capacity of concrete comes into play in this regard, and as more structures are designed and built

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WHAT’S INSIDE

ccanz
Cement & Concrete Association of New Zealand

Upfront "CCANZ Funding – a new model."

In the early 1980's the New Zealand Concrete Research Association was funded on a 50/50 basis by the government and the cement companies. By the end of that decade the government funding had ceased and the organisation was reformed to become the Cement and Concrete Association of NZ (CCANZ). Since that time primary funding has come from Golden Bay Cement, Holcim Cement and in later years Pacific Steel.

In the longer term, the cement companies have indicated that they wish to take a less dominant role in the funding of what is, in actuality, an industry organisation. This trend is supported internationally in both Australia and the United Kingdom, where the recognised industry associations, being the Cement and Concrete Association of Australia and the recently formed Concrete Centre in the United Kingdom, are both funded from the concrete and cement industries jointly on an approximately 50/50 basis. In the Australian model, funding level is based on sales volume, and in the United Kingdom the calculation is based on tonnes of cementitious product either produced or consumed.

This model clearly shares responsibility for generic industry activities across a more representative spectrum within the concrete industry. In both the above cases the respective ready mixed concrete industry association has been absorbed into the central association.

The drivers for the change to this new model in both markets are different. In the Australian situation the initiative was taken by the ready mixed concrete industry who had become frustrated with the inefficiency and duplication within that industry. They recognised that the Cement and Concrete Association of Australia (CCAA) were an efficient and well focused organisation and sought to bring their activities under that structure. The total funding available to the CCAA grew slightly from approximately $(A)4.1 million to $(A)4.6 million, however, the proportion of cement funding moved from 100 percent to 50 percent.

The Concrete Centre in the United Kingdom was formed in recognition that a need existed for a central concrete organisation to focus on regaining the dwindling market share for cement and concrete products in the United Kingdom's construction market. The funding required for this organisation was additional to that currently being applied to a variety of organisations and was deliberately targeted at a ratio of 50/50 for cement and concrete companies respectively. As with our market there is significant vertical integration and contribution from quarrying activities is included within the general concrete category.

This shift to a broader based funding model for CCANZ has been discussed over the last two years. CCANZ is currently preparing proposals for each of the major commercial sector associations being, the New Zealand Ready Mixed Association, New Zealand Masonry Association and Precast New Zealand, outlining the services currently provided and value added to their sector and the industry generally. This proposal will include a request for a share of primary funding.

Shared industry funding of the CCANZ will reinforce the cohesive approach of the last three years, by ensuring we remain focussed on appropriate issues and activities to provide the foundation for a prosperous tomorrow.

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using this science, awareness of the advantages of this design philosophy is spreading.

Designers are now looking for low energy methods of achieving thermal comfort. Here, the inherent benefits of concrete as a material can come into play. There have been several notable structures built using this design philosophy in the UK, and the designs have been recognised in Industry Awards as a consequence of their performance. Three such examples are the Lloyd's Register of Shipping building in London, the Canon HQ building at Reigate and the Toyota GB Headquarters at Epsom.

In New Zealand, the use of FES design principles has been accepted in upper market residential houses and there are signs that this is a growing market segment. The commercial market is less developed however, with one or two notable exceptions, i.e. the Maths and Science Building at Canterbury University.

Which parts of the structure can be used for FES?

Any section of the building can be used. The key point to remember is that it is important to keep the surfaces to be used free from isolating claddings or other coverings. This means that carpeted floors will not perform well, but exposed slab soffits will. These elements represent the largest volume and area within a typical structure and are usually well distributed throughout the building for maximum efficiency. Exposed columns and walls also act as good energy storage media.

Hollow floor slabs can be used overnight to reduce the concrete temperature by ducting cold evening air through the voids, thus removing the slowly accumulated heat generated by the daytime occupiers.

Ducts cast into the concrete can also be used to act as enhanced heat sinks by lowering the temperature of the concrete and increasing the temperature difference between the air and the concrete. Careful design will remove the risk of condensation forming on these sections.

What can be expected from a FES structure by way of thermal performance?

FES can reduce peak internal temperature by 5°C, shifting the peaks to later in the day, often after the occupants have gone home. A passive FES building can contribute a cooling effect of 15-20 W/m^2, which is sufficient to counteract the effects of computers and printers for an average office. A greater cooling effect of 25-35 W/m^2 can be achieved with an active solution, (some papers have reported values as high as 40 W/m^2) allowing comfort to be maintained at higher levels of internal heat gain.

If a significant area of concrete is to be exposed, then consideration should be given to the attainment of an

appropriate surface consistency and colour consistency for the concrete. To achieve smooth, consistent surfaces on soffits it may be advisable to cast in custom-made high quality steel or glass fibre lined moulds.

FES soffits in particular are most effective (for day lighting and lighting) if they have a white or pale coloured finish, which helps to reflect light onto workspaces. Special architectural concrete may be employed to achieve the desired finish, or normal structural concrete may be painted.

The designer of a concrete FES building should also address the issue of coordination and integration of services. At the concept design stage, the servicing strategies for lighting, electrics, telecommunications, fire alarm and sprinklers, wet services and HVAC need to be considered. Early resolution of servicing runs is desirable so that precasting design work can be started in earnest early on. Pre-planning is the key to optimizing both the construction efficiency and the operational longevity of an FES building.

Indicative performance guidelines

- Peak temperatures can be reduced by 5°C or more.
- Temperature peaks offset by up to 6 hours.
- A 50% reduction in carbon dioxide emissions if you can leave concrete walls, floors or ceilings plain or painted.
- A 25 W/m^2 of passive cooling capacity, which is more than adequate to cater for heat loading in a typical commercial building.
- Up to 40 W/m^2) can be achieved by forced ventilation through a hollowcore precast concrete floor.

Reference:

Glass, Jacqueline. (n.d.). Fabric energy storage with precast concrete. Retrieved January 09, 2004, from Trent Concrete Web site: http://www.trentconcrete.co.uk/library/energy_storage.cfm

Auckland Airport's carpark a world-first

A new car parking building at Auckland International Airport's domestic terminal is thought to be a world-first for New Zealand ingenuity.

All the 350 precast concrete components, including the foundations, were manufactured offsite by Stresscrete, delivered to the airport by trucks and then assembled and bolted together on site by Cassidy Construction.

Traditionally elements are welded or cemented together.

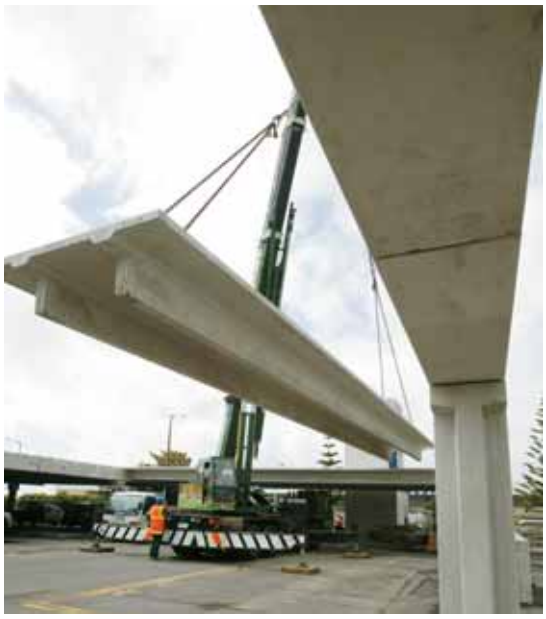
The construction method - like a giant concrete meccano set - made the site quieter and cleaner and car parking operations could continue nearby more easily.

More than 4500 tonnes of concrete was used with the largest component being a 17.5 m x 2.6 m precast floor panel weighing 20 tonnes.

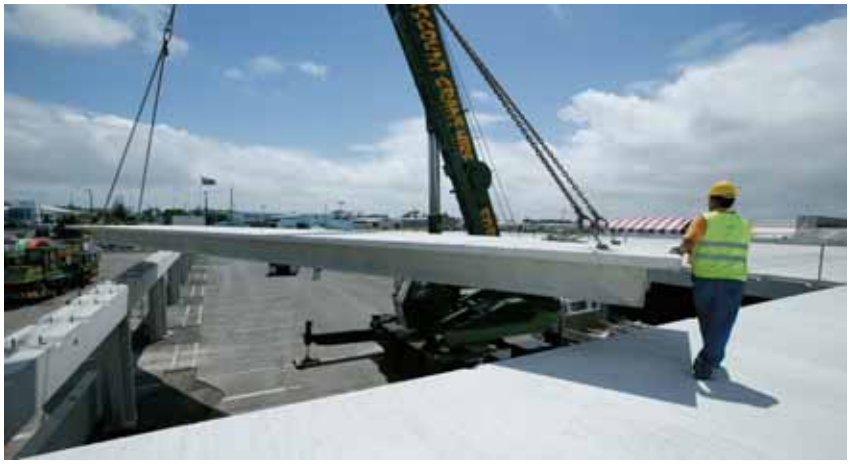
The 300-park building can also be easily unbolted, pulled apart and then reconstructed on another site, and could also potentially be converted into office space, although owner Auckland International Airport Ltd has no plans to use it for this.

Pim Rademakers from AIAL engineering management team says that they were impressed with the new style of construction. "It went up easily and enabled us to complete this important project with minimum disruption to normal operations," he said.

The project developer and owner of the rights to this building technology is Worldwide Parking Group (WPG), a subsidiary of Macquarie NZ Limited.



Right: All panels are manufactured offsite and bolted together onsite.



Above: The carpark's 17 metre long panels are eased into place at the AIAL carpark.

Precast Concrete a sustainable way for New Zealand construction

A return to precast concrete cladding would provide for more sustainable buildings better suited to the New Zealand environment, according to a research paper presented to the International Symposium on Concrete Structures.

In a paper entitled *Precast Concrete as a Sustainable Cladding Solution in New Zealand*, Senior Lecturer with Victoria University, Morten Gjerde, says over the past 10 years the increasing use of imported methods and lightweight cladding materials had resulted in many buildings developing problems with weather-tightness. This coupled with the need to consider sustainability in the built environment also called into question the use of imported cladding systems.

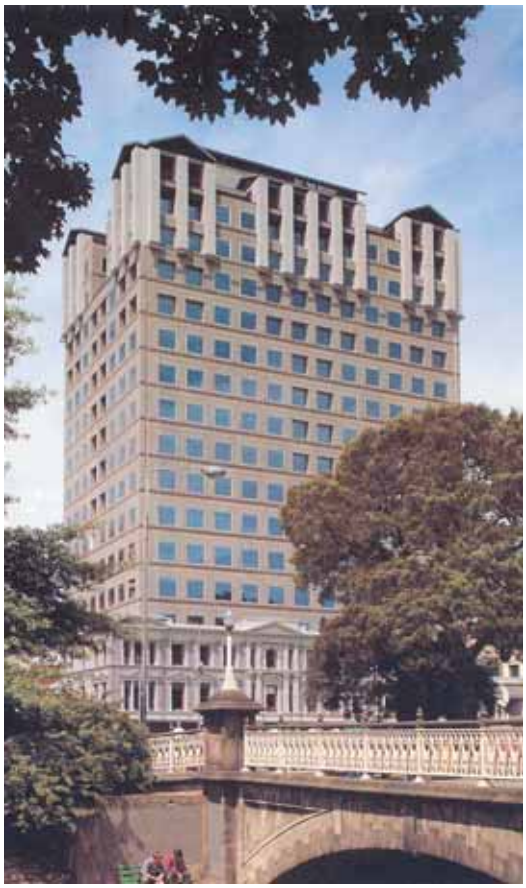
Owing to its remote location and the limited availability of materials, New Zealand's built environment had traditionally been constructed from local materials - timber and concrete - which were used in a manner that suited the unique environmental conditions.

In recent years the design and construction of commercial buildings has been influenced by overseas architectural fashion and by pressures for rapid completion.

"As the New Zealand building industry searches for improved cladding solutions and as there is pressure to increase the sustainability of our built environment, precast concrete cladding systems once again deserve serious consideration."

In contrast to lightweight cladding systems, precast concrete uses considerably less energy to construct, has inherently better insulation from temperature extremes and noise, and can be more readily recycled.

A recent study by the Centre for Building Research in Wellington has shown that the decision to use precast concrete cladding on the Clarendon Tower in Christchurch saved 4.2 million megajoules of energy - leading to an estimated cost saving of $142,000 at 2003 prices.



Northwest view of the Clarendon Tower in Christchurch.

These savings include the energy needed to manufacture the building as well as the distances needed to transport materials. The easy availability of concrete in New Zealand helps to minimise construction costs as well as improving the certainty of supply.

However, Mr Gjerde says one of the greatest qualities of concrete cladding is its thermal mass which has a moderating effect on temperature extremes.

"Most of the energy demand in large buildings is for cooling, mainly due to the heat generated within by people and machines. The transfer of heat from outside compounds this situation, but can be delayed by heavier weight materials such as concrete.

"The development of sandwich panel construction techniques, where an insulation layer is bound between two layers of concrete, will see the full thermal benefits of concrete cladding realised."

In addition, increasing environmental noise has lead to increases of unwanted noise within buildings. In Wellington, local authorities are requiring that residential buildings in the city centre achieve a minimum sound insulation level. The poor performance of lightweight building claddings and detailing around windows are areas of particular concern.

Concrete panels with a thickness of 150 mm easily comply with the noise insulation value, and using concrete as a mass material means there are fewer junctions where noise can leak into a building.

Sustainable practice requires a project to not only consider initial and ongoing maintenance cost, but also the value of a building at the end of its economic life.

Recycling and deconstruction of buildings is increasingly an important phase in the life of a structure. Unfortunately a large number of buildings are not constructed with recycling in mind, so they are simply demolished with the materials taken to the landfill.

In moderate to large buildings concrete cladding components are often not load bearing, so they are accessible and recyclable. Consequently the investment in material and energy resources does not have to be lost - and precast concrete claddings can be truly sustainable.

Cook's Clinic...

Concrete structures standard

The concrete structures standard (NZS 3101) is being rewritten with the first 10 chapters released for public comment on 19 March 2004 and the closing date for comments 25 June 2004.

A free copy of the draft can be downloaded from the Standards New Zealand web site www.standards.co.nz.

The public comment issue on this standard has been split into two instalments with the hope that commenting becomes a more manageable process for the many users of this standard. The first 10 chapters include design for durability, fire, properties of materials, methods of structural analysis, reinforcement, and the design of beams and columns.

Before embarking on the review of the standard, the committee sought the feedback of users. This was achieved through a series of presentations to the structural groups in November 2002. Actively seeking feedback proved to be a very successful strategy with plenty of comments being forwarded to Standards NZ.

Feedback indicated that users wanted:

- The standard to be subdivided into component chapters rather than forces
- The committee to investigate the adoption of overseas standards
- A chapter on precast concrete
- Two volumes, one on the standard and the other the commentary.

The committee was also given a clear message that the standard should be easy to understand, technically sound, and of a reasonable number of pages.

By downloading the standard you will be able to see how successful the committee has been. It is important to note that this is "work in progress" and the public comment stage, and the consideration of these comments, is probably the most important stage in the development of any standard.

Recently a series of presentations have been made to the structural groups to introduce the changes that have been made to the draft NZS 3101.

A copy of this presentation can be obtained by contacting me at dene@cca.org.nz . Innovations that have been included in the first 10 chapters are:

- The chapter heading have been aligned with AS 3600.
- The chapters are now based upon components, so if you are designing a beam you go to the chapter on beams.
- New chapters have been provided on the topics of materials, beams columns, and methods of structural analysis. These chapters mainly incorporate information that was in the existing standard but placed in a more logical order.
- Summary tables have been provided at the end of key chapters to make navigation around the standard much easier. These tables provide information on both formulas and clause references.
- Review of other overseas standards revealed that the most appropriate development option for NZS 3101 was to align the standard as closely as possible with ACI 318-02, without loosing the important design information that is already within NZS 3101.
- The durability chapter now provides information on supplementary cementitious materials, abrasion, fixing and fastenings, and durability modelling.
- The latest information from ACI 318-02 has been included where appropriate.
- The limited ductility chapter has been incorporated into the body of the document. The sections that cover ductile design incorporate the required detailing for both limited and fully ductile structures.
- The recent amendment covering hollowcore and Grade 500 reinforcement has been incorporated.
- Design for fire contains the latest thinking from the AS 3600.

I encourage all users of NZS 3101 to get hold of a copy of the draft document and provide the committee with feedback.

The final 10 chapters are programmed to be released for comment in the near future. This release will include the chapter linking NZS 3101 to the draft loading standard (NZS 1170.5), and a section on precast concrete.

Errata

Accompanying last issue's article was a photo of a slump test. Did you spot the mistake? The photo shows the Australian method of conducting a slump test. NZS 3112 requires the concrete to be struck off by a trowel and the slump measured to the highest point.

International News...

It's not easy building green

By Steven Prokopy

Constructing a high-rise apartment building in New York City has been a challenge since the city's early days of going vertical. Usual challenges include logistics concerning the movement of materials and personnel around the jobsite, keeping workers safe, sticking to the concrete cycle and staying ahead of apartment-leasing demands. But when the building in question is not only a high-rise but also the first "green" apartment complex in the entire United States in a neighbourhood that is fast becoming a hotbed of green building activity, the challenges become even greater. Add to this, the site being only four blocks from the former World Trade Center and under construction on 9/11, and without warning the effort becomes unprecedented. Despite all of this. The Solaire is more than 80 percent leased.

Located in New York's Battery Park City neighbourhood at the southwestern tip of Manhattan, The Solaire is the first new residential construction to be completed in downtown Manhattan since 9/11; and also the beneficiary of the nation's first green building tax credit, enacted by New York Governor George Pataki three years ago. Gov. Pataki led The Solaire's dedication festivities in Sept. 2003.

The 293-unit, 27-storey, US$120 million tower has been environmentally engineered to consume 35 percent less energy, reduce summer peak demand for electricity by more than 65 percent, use one-third less potable water, provide healthier indoor air quality and offer substantially more natural light than typical residential buildings. Another major feature of the complex is the use of building materials with high recycled content, or manufactured with renewable or rapidly renewable resources, free of added urea formaldehyde and containing low or no volatile organic compounds. In the end, about 50 percent of the final building material was composed of recycled content.

The Solaire was built to meet three different sets of green guidelines: the Battery Park Residential Environmental Guidelines for New Construction, the U.S. Green Building Council's LEED (Leadership in Energy and Environmental Design) Rating System, and the New York State guidelines to qualify for the tax credit. The project's adherence to lofty environmental goals resulted in a November 2002 (construction phase) visit by former Soviet President Mikhail Gorbachev. As the head of Green Cross International, a sustainability proponent, Gorbachev announced a partnership with the Battery Park City Authority to share its green guidelines with developers around the world.

With the tax-credit guidelines, at least 40 percent of the building's components had to be manufactured no further than 500 miles from the job site. General contractor Turner Construction Co. exceeded that goal as 50 percent of materials (by cost) were delivered from within that radius.

The Solaire, New York City.

According to Marty Dettling, vice president of Solaire owner/developer Albanese Organizations, reinforced concrete was the obvious choice for a green building because concrete comprises thermal mass that provides insulation against heat loss. New York's Empire Transit Mix was the primary concrete supplier, delivering much of the job's 10,000 yd. The Solaire features a 15,000 sq.-ft. footprint up to the 16th floor; the 17th-27th floors have a 8,000-sq.-ft. footprint. The structure incorporates about 60 columns per floor, with an average bay size of 12 ft. by 24 ft.; floor slabs are 7 in. thick.

In keeping with the spirit of using recycled products in construction, fly ash was mixed with cement at an 18 percent replacement rate (or 3-4 percent of the total concrete mix design). "We also looked into using slag cement, but there were no slag storage silos in the immediate area," adds Dettling. "But, we conducted tests and realized we could use much higher recycled content - about 40 percent - with slag cement. The product is now available to us through Lafarge, who also supplied The Solaire with cement and fly ash."

9/11 SHIFT

With construction on The Solaire beginning in May 2001, the foundation was almost complete and the superstructure concrete subcontractor was pouring the first floor slab when the two planes hit the World Trade Center towers on 9/11. Many of the Solaire site's labourers, carpenters and electricians went to Ground Zero to work on the clean-up operation. In addition, several pieces of excavation equipment and a crane

from The Solaire were commissioned by the Fire Department of New York, and the project's field office was used as Turner's first site office for the WTC recovery starting September 12. Carlo DiSilvestro, Turner's project manager for The Solaire, became a part of the firm's management team for the WTC 7 cleanup.

Needless to say, The Solaire site was closed down after 9/11, with Turner returning in mid-October to mothball the site. Construction resumed full-time in July 2002. "The site was actually available for us to begin again at the end of October 2001, but the combination of security measures and traffic issues involving rerouting the mixer trucks led us to the decision to delay resuming construction," Marty Dettling says. "We did time tests with the trucks around that time and every day we got different results. We didn't want to compromise the quality of the concrete, so we decided to wait."

Structural engineer Cantor Senuk Group received an Award of Excellence for The Solaire from the Concrete Industry Board of New York. The project has also been a centre of the New York City Concrete Promotional Council.
Design architect: Cesar Pelli & Associates
Project architect: SLCE Architects
Reproduced courtesy of Concrete Products
www.concreteproducts.com

News...

Dene Cook elected Fellow of IPENZ

Dene Cook, Project Manager, Cement and Concrete Association NZ, was elected a Fellow of The Institution of Professional Engineers New Zealand (IPENZ) for his contribution to the advancement of engineering practice. The award specifically recognised his contribution to development of standards for concrete construction.

Mr Cook is a leading structural engineer who has played a key role in the preparation and delivery of submissions on structural issues as well as chairing the NZS 3101 Concrete Structures Standard Technical Committee.

"Receiving a Fellowship carries substantial prestige. It is not a reward for long service or for advancement in seniority with one's employer, rather it is recognition by IPENZ of the contribution of outstanding individuals," said IPENZ Chief Executive, Andrew Cleland.

CCANZ concrete prizes

CCANZ has awarded $500 professional prizes for excellence to two students from the University of Canterbury's Schools of Engineering. Sandra Shewan received a prize for Excellence in Concrete Materials and Henry Tatham was awarded a prize for Excellence in Reinforced Concrete Design.

Website Promotes Green Building

The Portland Cement Association in the United States has recently launched a new resource to promote sustainable construction and the responsible use of cement and concrete products in building projects. The website has tools to highlight the positive environmental benefits of cement and concrete.

See www.sustainableconstruction.org

36th Combined Conference

The 2004 Conference of the Institute of Quarrying NZ and Aggregate and Quarry Association of NZ will be held at Wairakei Resort, Taupo on July 14-16, 2004.

Chris Munn of CCANZ will present a paper entitled *Alkali Silica Reaction - What New Zealand Aggregate Producers Should Know About Minimising the Risk of Damage to Concrete*, co-written by Sue Freitag of Opus International Consultants.

Further details on the conference can be obtained from Kelvin Strong, email kelvin@nzcontractors.co.nz, or www.aqa.org.nz, or www.ioqnz.co.nz.

Record entries for House of the Year Competition

More than 580 entries – the highest number ever received – have been submitted for this year's Registered Master Builders House of the Year Competition.

Now in its 14th year a restructured award and an increase in builder membership have contributed to the 5 percent increase on last year's entries says Registered Master Builders Federation CEO Chris Preston.

Last year's winner was a three-bedroom concrete home in Christchurch built by Clive Barrington Construction. Judges described the $1.5 million home as an outstanding example of construction skills.

This year the introduction of gold, silver and bronze House of the Year quality marks will mean that more builders can be recognised for superior work.

Each of the 20 local associations' gold, silver and bronze winners will be announced during June and July with gold winners proceeding through to a national moderation and judging panel.

National winners in the residential and commercial categories and the supreme overall winner will be announced in Auckland on 25 September 2004.

NEWS from the ASSOCIATIONS

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Chairman: Angus McMillan,
Secretary: Michelle Rauner
021 669 560

DIARY:

2004

July

22 PCNZ Executive Meeting, Auckland

August

3 NZRMCA Meeting, Wellington

19 NZCS Council Meeting, Wellington

September

16-19 Combined Concrete Industry Conference, Queenstown

16 CCANZ Board Meeting & AGM, Queenstown

16 PCNZ AGM, Queenstown

December

7 CCANZ Board Meeting, Wellington

7 NZRMCA Meeting, Wellington

Department of Corrections — PCNZ

The Executive committee will approach the Minister of Corrections to put the PCNZ case regarding the manufacture of precast panel components for a commercial complex by the Department of Corrections. In addition letters of support for the PCNZ case will be sought from selected members of the building industry to be presented to the Minister.

Conditions of Sub-contract — PCNZ

The committee formed to develop benchmark conditions of sub-contract agreement and quotation are now preparing draft conditions of quotation for sub-contracts. The work on this project was held over until the implications of the Construction Contracts Act, in force for over a year now, and industry reaction was clear. The conditions of quotation will build on the work of the NZ Building Sub-contractors Federation and previous work carried out by the Executive of PCNZ.

PCNZ Website — PCNZ

The PCNZ website update is now complete. The home page features and promotes alternating examples of precast concrete construction by selected and credited specifiers. You can find it at www.precastnz.org.nz

London City and Guilds Correspondence — NZRMCA

Registrations are now being taken for the London City and Guilds correspondence course for Concrete Technology, Part 1: General Principles; and Part 2: Practical Applications, in preparation for the May 2005 examinations. The course is also a significant part of the National Certificate in Concrete Technology syllabus which allows the LCG qualification to account for approximately 85% of the NCCT requirements. Registration forms can be obtained from the Registrar, WELTEC, Private Bag 39803, Wellington, Tel 04 920 2400 or from the course tutor David Barnard, Tel 04 232 6684, Fax 04 2326689, email godivadh@actrix.co.nz.

Self Compacting Concrete — NZCS

A small group of industry representatives has volunteered to consider the information training and research needs required to promote the use of self compacting concrete (SCC) in NZ. The group consists of Derek Chisholm (NZCS and BRANZ), Len McSaveney (NZCS and Golden Bay Cement), Sheldon Bruce (NZCS and Opus International Consultants), Nick Kerr (Holcim Cement), Michael Khrapko (Stevensons Concrete), and Chris Munn (CCANZ). The group is currently considering the suitability of bringing a world expert in concrete rheology to NZ to run training courses. Other issues being considered include preparation of guidance documents; NZ 'open times' for SCC compared with international norms; surface finish benefits; an SCC discussion forum and commercial implications of SCC.

Future Proofing — NZCS

The NZ Concrete Society is due to announce its Study Fellowship for a student from a tertiary institution undertaking a postgraduate study. The fellowship will provide up to $1000 a year for up to three years.

Student Prize Winners — NZCS

To encourage good practical design and use of concrete, each year the NZ Concrete Society awards prizes to students demonstrating outstanding ability at the Schools of Engineering at the universities of Canterbury and Auckland; and the Schools of Architecture at the universities of Victoria and Auckland. This year the recipients are John Bolland, Civil Engineering, Auckland University: Hannah Victoria Woon and Sara Weichmann, Architecture, Auckland University: Liam Taylor, Engineering, Canterbury University. Winning students receive a cheque for $300 and a year's complimentary student membership to the society.

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