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construction innovation

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At April meeting of CCBFC most code changes approved, a few delayed

The Canadian Commission on Building and Fire Codes (CCBFC) met in April in Victoria, BC to approve the technical content and objective-based format of the 2005 national model codes (building, fire and plumbing).

Most of the technical changes recommended by the CCBFC standing committees after public review were approved. However, the Commission withdrew, or delayed approval of, several significant changes as follows:

- **Structural design:** National Building Code (NBC) Part 4 Structural Design proposed changes were approved except for those dealing with seismic design. The vote on the proposed changes regarding seismic design was deferred because one province requested more time to evaluate the impact of such changes. The Commission will vote on the changes in the fall of 2004.
- **Maximum hot water temperature at fixtures:** The proposed change to the National Plumbing Code (NPC) establishing a maximum hot water temperature of 49°C at fixture outlets in residential occupancies was put on hold. It will be reconsidered pending a review by an ad hoc group, which was formed to address provincial and territorial concerns raised about enforcement and the possibility of Legionella bacteria becoming a problem if water temperatures in storage tanks are set too low. The Commission will vote on the changes in the fall of 2004.
- **Shut-off valves for all plumbing fixtures:** A proposed change to the NPC requiring shut-off valves for all plumbing fixtures in residential occupancies was not approved. The Commission accepted the recommendation of an ad hoc group formed to review provincial concerns that these changes went beyond the mandate of the NPC to provide minimum standards.
- **Hydronic heating standard:** The Commission supported a recommendation of the Standing Committee on Houses not to reference the CSA-B214 standard on hydronic heating in NBC Part 9 at this time. However, the standard will be referenced in NBC Part 6. CSA has committed itself to reviewing all the technical issues raised by industry and the provinces and territories, and to updating the standard as soon as possible. There is a possibility that it could be referenced as an early Interim Change to the 2005 NBC.
- **Durability:** References to the CSA-S478 guideline on durability were withdrawn from two proposed changes for NBC Parts 2 and 5. The Commission's concern was that the CSA document called for set time periods for the performance of materials and assemblies, which is a warranty issue and not related to health and safety.
- **Party walls on property lines:** Proposed changes to NBC Parts 3 and 9 eliminating requirements for party walls on property lines to be constructed as firewalls were not approved because of concerns about their legal impact. These changes will be considered again in the next codes cycle.
- **Lateral loads – NBC Part 9:** Proposed changes to NBC Section 9.4. requiring lateral loads to be

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Highlights

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Building Science Insight
Seminar Series–2004
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Building a Better Cubicle
Cost-effective office design

Organized by: Institute for Research in Construction
National Research Council Canada

The single most common workplace in North America is the open-plan office, or "cubicle." People who work in this type of office spend more waking hours in this environment than in any other, and there is abundant evidence that they do not generally enjoy the experience.

This one-day seminar will address how open-plan offices can be ergonomically designed to improve the workplace environment and occupant satisfaction, with consequent benefits to an organization's bottom line.

The seminar will address several topics:

Organizational Productivity. Defining productivity for "white-collar" work is notoriously difficult. Nevertheless, there is a growing body of evidence to suggest that improved environmental satisfaction is linked to increased job satisfaction and superior organizational productivity. A multi-dimensional model of organizational productivity will be described and evidence regarding the effects of the office environment reviewed.

Meeting Occupant Needs Through Workstation Layout. The open-plan office should be designed to meet:
(1) the needs of the task
(2) the need to control information flow
(3) the need for individual recognition within the organization.

These needs are better served if employees have input into the design process and the possibility of modifying their environment when necessary.

Acoustics. Most office workers desire speech privacy when at their desk. They do not want to be overheard or to be distracted by conversations elsewhere in the office. The effect of office design parameters, such as cubicle size, panel height, ceiling-tile characteristics and the use of masking noise on speech privacy and occupant satisfaction, will be illustrated.

Ventilation, Indoor Air Quality and Thermal Comfort. A successful ventilation strategy for an office building is founded upon controlling pollutant sources and supplying an adequate level of outdoor air for the number of occupants. In addition, local sources of thermal discomfort and draft should be controlled. Appropriate strategies will be discussed.

Lighting and Daylighting. Research shows that people prefer bright spaces, as long as they are glare- and flicker-free. Satisfaction is also improved with access to daylight. Office design choices can have a substantial effect on the luminous environment. The effect of lighting equipment types, cubicle size, panel height, surface colours and ceiling height will be demonstrated.

Seating, Posture and Office Equipment. A growing number of office workers report musculoskeletal injuries attributed to poor workstation ergonomics. The proper design of seating, work surfaces and computer equipment will be reviewed in the context of the CSA Guideline on Office Ergonomics and examples of positive ergonomic interventions presented.

Software Tools. IRC has developed two free software tools to aid in the design of open-plan office environments. The first focuses on acoustics and speech intelligibility, and the second examines the office environment more broadly, indicating both physical and occupant satisfaction effects. The seminar will include tutorials on both software tools, with worked examples.

The one-day seminar will be held in the following locations:

- ***Fredericton, October 13, 2004***
- ***Charlottetown, October 15, 2004***
- ***St. John's, October 18, 2004***
- ***Halifax, October 20, 2004***
- ***Edmonton, November 1, 2004***
- ***Yellowknife, November 3, 2004***
- ***Winnipeg, November 5, 2004***
- ***Toronto, November 8, 2004***
- ***Whitehorse, November 16, 2004***
- ***Vancouver, November 18, 2004***
- ***Vancouver, November 19, 2004***
- ***Calgary, November 22, 2004***
- ***Saskatoon, November 24, 2004***
- ***Toronto, November 26, 2004***
- ***Ottawa, December 2, 2004***
- ***Sainte-Foy (French), January 18, 2005***
- ***Montreal (French), January 20, 2005***

The registration fee for the seminar is $329 plus tax. Go to the Web site (http://irc.nrc-cnrc.gc.ca/bsi/2004) for more details and registration information.

Construction codes

We've "renovated" the National Housing Code!

The revised edition of the *National Housing Code of Canada 1998 and Illustrated Guide* is available in two practical, portable formats: an 8.5 x 11 soft-cover book and a Special Edition CD-ROM with improved search and print capabilities.

This comprehensive two-in-one reference document will help you build with ease. The Code portion contains all the National Building Code requirements from Parts 1, 2, 3 and 9 that are related to the construction of single detached, semi-detached and row houses. These requirements have been re-ordered so as to reflect the sequence in which housing is actually designed and built. The Guide portion clarifies the Code requirements with additional information, examples of industry building practices, and over 300 colour illustrations. It deals with a wide spectrum of building issues, such as foundations, sound transmission, windows, and garages.

This revised edition contains updated information, improved figures and three revisions. Current owners of the National Housing Code can download the pages with revisions from IRC's Web site at http://irc.nrc-cnrc.gc.ca/catalogue/housing.html.

The soft-cover version of the National Housing Code is now available for $94, and the CD-ROM version for $179. An invaluable resource for home builders, designers, building officials, inspectors and contractors…and you! To order, contact IRC's Publication Sales department:

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At April meeting of CCBFC most code changes approved, a few delayed

Continued from cover page

addressed in certain circumstances were not approved. One province raised concerns about their impact on new housing construction and requested more time to conduct its study. These changes will be considered again in the next codes cycle.

- **Electrical conductors:** Proposed changes expanding the requirements for fire protection of electrical conductors in NBC Article 3.2.6.9. were not approved because of concerns raised by one province about cost implications. These changes will be considered again in the next codes cycle.

For more information on the status of these proposed changes, please contact John Archer, Secretary, CCBFC at (613) 993-5569, fax (613) 952-4040, or e-mail john.archer@nrc-cnrc.gc.ca.

Call for new members for CCBFC and its standing committees

The CCBFC decided to review the scope and structure of its standing committees before renewing their membership for the next codes cycle, set to begin in the fall of 2005. A joint task group made up of CCBFC and provincial and territorial representatives will make recommendations to the CCBFC by the end of February 2005 on code development priorities for the next codes cycle. These recommendations will help the CCBFC establish the scope of each standing committee and its terms of reference.

Over the next year, a membership renewal process for both the Commission and its standing committees will take place. People from industry and the provincial, territorial and municipal jurisdictions, as well as members of the general public, who are interested in participating in one of the committees are encouraged to submit their résumés. Information on how to apply can be found at http://www.nationalcodes.ca/apply_contact_e.shtml.

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Researchers at IRC investigate fire-detection alternatives for Canadian correctional facilities

Nuisance fire alarms can be a problem in Canadian correctional facilities when inmates intentionally activate or damage in-cell smoke detectors, which are currently required under the National Building Code of Canada. These alarms result in increased risk to guards and inmates while the detector is out of service, time lost as guards investigate the cause, and significant costs to examine and replace damaged detectors.

To find a solution, the Correctional Service of Canada (CSC) initiated a project with researchers in IRC's Fire Research Program and Ken Richardson Fire Technologies Inc. They set up a series of full-scale tests in temporarily vacated correctional facilities in Kingston, Ontario, to determine if in-cell smoke detectors could be moved outside of cells and still provide an equivalent level of fire protection. In particular, they were interested in ensuring that the risk to inmates in the cell of fire origin would not exceed critical limits for carbon monoxide, carbon dioxide and temperature if the detectors were located outside the cell.

The researchers developed various test scenarios that would be representative of the fires that actually occur in cells, while still posing a reasonable challenge for the detectors expected to respond. These scenarios involved different fire sources (such as CSC-issue mattresses and clothing, and newspaper) for both open-front and closed-front cells. Depending on whether the cell had an open or closed front, the researchers varied the location of the fire source. They then recorded the times of response for in-cell, outside-cell and duct detectors, and measured the conditions inside the cell of fire origin for a full 15 minutes.

In all scenarios, the researchers concluded that early detection with smoke detectors in an exhaust duct adjacent to a cell was equivalent to that provided by in-cell smoke detectors in both open-front and closed-front cells. Specifically, the researchers found that moving smoke detectors from inside to outside open-front cells, to either a duct or the corridor, did not affect reaction times enough to allow critical conditions to build up in the cell where the fire originated. For closed-front cells, they found that only smoke detectors relocated to an exhaust duct provided an equivalent level of fire detection. In some cases, smoke detectors moved to the corridor allowed critical conditions to build beyond acceptable levels in the cell of fire origin.

With the results from this project, CSC now has the technical information it needs to propose a reliable, cost-effective alternative to in-cell smoke detectors to the authority having jurisdiction.

Specific questions about this project and its findings can be directed to Dr. Joseph Su at (613) 993-9616, fax (613) 954-0483, or e-mail joseph.su@nrc-cnrc.gc.ca.

IRC's intermediate-scale furnace: a promising new tool that could reduce costs of fire-resistance testing

Fire-rated floor and wall assemblies made of new materials and using non-traditional construction methods are increasingly being used in buildings today. At present, full-scale tests are used in the development of new assemblies. But because these tests are expensive and time consuming, IRC's Fire Research Program has tried to find a simpler and less expensive approach.

Researchers recently constructed an intermediate-scale (1.2 m by 1.8 m) furnace (see photo) that can be used for testing wall and floor assemblies—both loaded and unloaded structurally. While the development of a non-standard intermediate-scale furnace test method is not intended to replace the full-scale method, it is likely to reduce the number of full-scale tests needed during the design and development phase of

Continued on page 11

The intermediate-scale furnace, which is approximately 1/6 the size of IRC's full-scale furnace

Fire researchers report breakthrough on FRP-strengthened concrete columns

Working in collaboration with researchers from Queen's University and industry, researchers from IRC's Fire Research Program have found that, with proper design and added fire protection, FRP-strengthened columns, slabs and beams can provide required fire endurance.

The partners in the project include the members of the Intelligent Sensing for Innovative Structures Network (ISIS Canada) at Queen's, Fyfe Co., and Watson-Bowman Acme, a division of Degussa Construction Chemicals.

FRPs, or fibre-reinforced polymers, are a new class of materials that are high in strength, lightweight and non-corrosive. Because of their promise and the urgent need for new materials and techniques to repair North America's crumbling infrastructure, FRPs have garnered significant research attention in recent years. Their effectiveness as externally bonded repair materials is now widely recognized. However, until recently, limited work has been done on their performance in fires, which has kept them from being used with confidence in buildings where fire safety is a critical design consideration.

To date, the researchers have conducted fire-endurance experiments on three loaded full-scale columns (two circular and one square), four unloaded intermediate-scale reinforced concrete slabs, and two loaded full-scale reinforced concrete beam-slab assemblies. Each of these was strengthened with carbon and/or glass FRP wraps and insulated with a specially designed fire-protection system that included spray-applied insulation and an intumescent paint.

Typical circular, insulated FRP-strengthened concrete column before and after fire testing

…FRP-strengthened columns, slabs and beams can provide required fire endurance, if they have been properly designed and have adequate fire protection.

In each of the experiments, the insulated FRP-strengthened members achieved fire endurance (i.e., maintained structural integrity and stability) in excess of four hours. Furthermore, the insulated FRP-strengthened members achieved this fire endurance even though they exceeded the glass transition temperature of the FRP polymer matrix/adhesive early in the period of fire exposure. (The glass transition temperature is the temperature at which the material becomes brittle rather than flexible.)

Until these tests were run, it had been assumed that the FRP temperature had to be kept below this level to satisfy fire-endurance requirements. The research clearly demonstrated that the FRPs, in combination with the fire-protection system, can provide an equivalent level of fire endurance to that of undamaged reinforced concrete even though the FRP loses its structural integrity once the glass transition temperature is exceeded.

"We found these results unexpected and extremely encouraging," says IRC's

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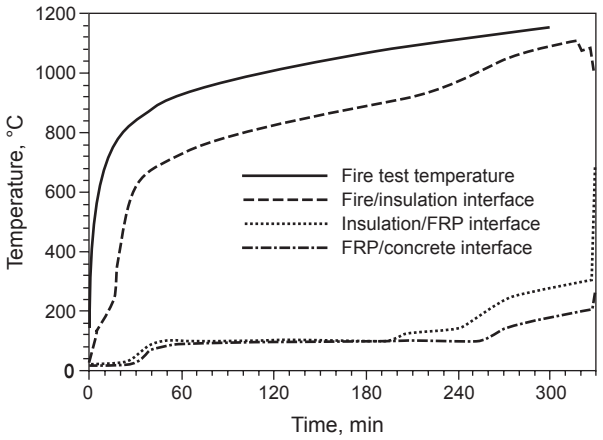


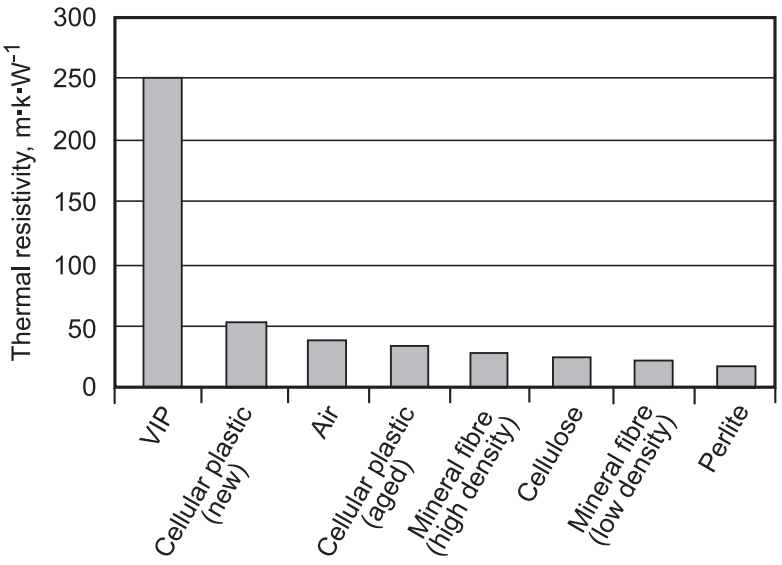
Temperatures recorded at various locations on a circular, insulated FRP-strengthened column during fire test

IRC seeks industry collaborators for research on vacuum insulated panels

In these times when the pressure for environmental restraint is mounting, any new technology that assists efforts to reduce, reuse and recycle is welcome. Researchers in IRC's Building Envelope and Structure Program believe one particularly promising area for development is vacuum insulated panels (VIPs), and they are looking for industry partners to assist them in their work. In return, participants will gain early access to information about the application of these insulation materials and technologies that will help them develop innovative solutions for the built environment.

One of the new breed of high-performance insulation materials, VIPs can be up to ten times more efficient than other insulation products currently in use, with the same thickness (see figure). They exploit the well-known phenomenon that the absence or reduction of gaseous pressure inside a porous material increases its thermal insulating potential. This effect becomes even greater in materials that already have high thermal insulating values, and can be increased still further by applying the latest scientific and technological developments in other fields such as nanotechnology.

The size and insulating properties of VIPs are particularly valuable in situations where space is at a premium, such as in building retrofits and in heaters, chimneys, pipe-work and wall assemblies. Their use in Canadian construction could potentially reduce the thickness of building envelopes. More importantly, their use could also reduce energy consumption and carbon dioxide generation, helping Canada fulfill its commitments under the Kyoto Protocol.



Thermal resistivity of VIPs compared to that of several common insulating materials

One of the new breed of high-performance insulation materials, VIPs can be up to ten times more efficient than other insulation products currently in use, with the same thickness.

With this project, IRC will pick up where an important International Energy Agency (IEA) research project leaves off (see *Construction Innovation*, Volume 6, Number 2, Spring 2001). The IEA project, in which IRC was involved, demonstrated that VIPs could be used in building envelope applications and that the long-term performance of VIP prototypes was not affected when they were exposed to elevated temperatures and relative humidities. The projected performance indicated that VIPs would retain their high thermal resistance even after 100 years. Now IRC will focus on:

- confirming and expanding upon these findings;
- using the latest advances in micro-porous and nano-porous materials to improve VIPs; and
- developing guidelines for the application of VIPs in the field.

The project has already attracted substantial funding for three years from a number of organizations. However, to ensure representation from all interested parties, IRC would also like to include industry partners willing to take a proactive role in the research and development of VIPs.

If you are interested in learning more about how you can get involved, please contact Dr. Phalguni Mukhopadhyaya at (613) 993-9600, fax (613) 998-6802, or e-mail phalguni.mukhopadhyaya @nrc-cnrc.gc.ca.

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National Plumbing Code 1995	*$59*		*$54*			*$89*	*$178*	*$356*	*$534*
User's Guide on the National Plumbing Code	*n/a*		*$47*			*$85*	*$170*	*$341*	*$511*
National Farm Building Code 1995	*n/a*		*$34*			*$51*	*$102*	*$204*	*$306*
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Revised: September 2004

Infrastructure researchers evaluate proprietary concrete bridge repair systems

More than 40 per cent of Canada's highway bridges were built over 40 years ago, and many are in need of rehabilitation and replacement because of corrosion-induced damage to the steel reinforcement embedded in the concrete. The cost of the required work has been estimated at $10 billion.

To help address the need for a broadened knowledge base and new repair technologies, researchers from IRC's Urban Infrastructure (UI) Program and the Ministry of Transportation of Ontario (MTO) initiated a partnership in 1999 on a three-year project to field-test five proprietary commercial concrete repair systems. The objective of the project was to assess the effectiveness of these commercial systems in preventing the corrosion of steel reinforcement and shrinkage cracking.

The field-testing for the project took place on a highway bridge, the CNR overpass near Renfrew, Ontario. The IRC and MTO researchers used five proprietary commercial repair systems and one control system of normal concrete to create a series of test patches on different sections of corrosion-damaged reinforced concrete barrier walls. This type of bridge component was selected so that the test patches would be exposed to real outdoor conditions, including freeze-thaw cycles, wet-dry cycles and de-icing salt contamination.

During the patching process, the IRC researchers installed a set of embedded sensors in each of the test sections and in the surrounding concrete to monitor internal changes in temperature, relative humidity, strain, corrosion potential and electrical resistivity. Once the patches were completed and the sensors in place, the MTO researchers focused on external monitoring, which involved visual inspections, de-lamination surveys and additional surface corrosion measurements. This dual approach gave the researchers both inside and outside views of the test sections and allowed them to combine results from the two monitoring methods to determine the effectiveness of each commercial system.

Based on these early results, the findings from both monitoring methods indicated that the commercial proprietary repair systems performed slightly better in delaying the onset of corrosion when compared with the control system that used normal concrete. However, they did not perform better than the control with respect to shrinkage cracking, which appeared on all patches, including the control.

With regard to monitoring methods, the project showed that the remote monitoring with embedded sensors and external monitoring using non-destructive techniques are both effective and reliable methods of performance evaluation.

The researchers involved in this project are proposing an extension of the study for three more years, which would provide valuable additional information about corrosion and the overall performance of these proprietary systems.

Specific questions can be directed to Dr. Daniel Cusson at (613) 998-7361, fax (613) 952-8102, or e-mail daniel.cusson@nrc-cnrc.gc.ca.

Fire research

Fire researchers report breakthrough on FRP-strengthened concrete columns

Continued from page 5

Dr. Venkatesh Kodur, one of the principal investigators in the project. "It greatly advances our understanding of the fire performance of fibre-reinforced polymers, which IRC has been working on for four years. The involvement of the team from Queen's, led by Dr. Mark Green, also opens up a new field of research at that university and fulfills the mandate of ISIS Canada, one of the National Centres of Excellence, to train uniquely and highly qualified personnel in Canada."

Over the next year, IRC, in conjunction with Queen's, is planning a series of further tests that will include full-scale experiments on previously untested FRP-strengthened concrete columns and beam-slab assemblies. These experiments will examine the fire performance of different FRP strengthening materials and insulation systems. The results will help in verifying and extending numerical analysis tools, and in developing fire-design guidelines for FRP-strengthened concrete members.

If you are interested in joining this project or have specific questions about it, please contact Dr. Venkatesh Kodur at (613) 993-9729, fax (613) 954-0483, or e-mail venkatesh.kodur@nrc-cnrc.gc.ca.

Membership on IRC's Advisory Board

Key to IRC's success in meeting the needs of the construction sector is the guidance it receives from its Advisory Board. This Board provides an essential link to changing trends and expectations of the industry and society as a whole. It contributes invaluable advice to IRC on its future directions, as exemplified during the recent development of the Institute's new Strategic Plan 2004-09 (See http://irc.nrc-cnrc.gc.ca/fulltext/nrcc46892/nrcc46892.pdf).

Members of the Board are appointed by NRC's Council as individuals to represent senior levels of industry from domains such as building regulation, construction products and government, and from groups such as building owners, contractors, engineers and architects. To benefit from new ideas and perspectives, a portion of the membership is regularly replenished.

Effective July 2004, members of the Board include:

Mr. Michael Baetz (Chair), President & CEO, Ainsworth Inc., Toronto
Dr. Ali Arlani, Director, Building & Development Branch, Municipal Affairs & Housing, Government of Ontario, Toronto
Mr. Jean-Luc Dion, Director, Design and Construction, Ivanhoe Cambridge Inc., CDP Capital Centre, Montreal
Mr. Paul Giannelia, President, SC Infrastructure Corp., Calgary
Dr. James E. Hill, Acting Director, Building and Fire Research Laboratory, National Institute of Standards and Technology, Gaithersburg, MD
Ms. Maureen McCauley, Principal, McCauley Nichols, Goderich, ON
Mr. Richard (Dick) Miller, President, Clayton Developments Limited, Halifax
Dr. Aftab Mufti, President ISIS Canada, Winnipeg
Dr. Alan Pelman, Vice-President, Technology, Canada, Weyhaeuser, Vancouver
Mr. Philip Pratt, Principal, PHB Group Inc., St. John's

Retiring from the Board after several years of service are:

Mr. Harvey Bernstein, former President of the Civil Engineering Research Foundation, Washington, DC
Mr. Lewis Nakatsui, President, Lincolnberg Homes, Edmonton

For more information, please contact Louise de Ruiter at (613) 993-6748, fax (613) 941-0822, or e-mail louise.de_ruiter@nrc-cnrc.gc.ca.

Call for nominations for CCA Excellence in Innovation Award

The Canadian Construction Association and NRC's Institute for Research in Construction invite construction companies to submit their nominations for the CCA Excellence in Innovation Award, one of the industry's most prestigious awards for innovation in Canadian construction practice.

The CCA Excellence in Innovation Award
supported by NRC's Institute for Research in Construction

The award comes with the Hugh R. Montgomery Memorial Trophy.

Innovation in construction practice can be defined as an ingenious solution to a problem arising in the course of construction that demonstrates the practical skills by which designs are translated into reality. Examples of this include new protective measures for winter work, new fabrication techniques to minimize erection welding, new uses of existing equipment, new fittings to standard equipment for a special purpose, the adaptation of equipment for unusual uses, or the application of well-known materials in new ways.

The competition is open to all Canadian firms who think they have innovations worthy of consideration for this award.

To view the award's terms of reference and nomination form, please consult CCA's Web site (http://www.cca-acc.com/overview/awards/awards.html). The deadline for submissions is December 3, 2004.

What we're hearing

Canada and Taiwan share research interest in construction technologies

Hosts of the Canadian delegation to Taiwan
The Workshop and tours were organized under the joint agreement between the National Research Council of Canada and the National Science Council of Taiwan. The hosts for the Workshop and tours were:
- National Science Council (NSC) of Taiwan
- National Center for Research on Earthquake Engineering (NCREE)
- Architecture and Building Research Institute (ABRI)
- National Cheng-Kung University

Construction practice around the world is diverse, and yet there are common aspects that can lead to opportunities for cooperation between countries. With this in mind, 11 delegates from NRC and Carleton University, involved in the field of construction research, travelled to Taiwan in April on a fact-finding visit.

The weeklong stay was kicked off by a workshop on construction technologies at which researchers from both countries presented their current research focuses, including technologies currently being developed. The workshop was followed by technical tours (with visits to world-class research institutions in Taipei and Tainan), cultural visits and formal gatherings arranged by each of the hosts (see box).

Canadian delegates and Taiwanese hosts inside ABRI's full-scale wind tunnel (turned off at the time!)

Over the course of the visit, a number of issues emerged as being high on Taiwan's list of priorities. Many of these issues are recognized as being of importance to Canada as well, and are reflected in Canadian research directions.

Because the island of Taiwan owes its existence to the intersection of several major tectonic plates, earthquakes are a fact of life there; hence state-of-the-art earthquake engineering is essential. The Taiwanese are particularly interested in technologies that can minimize building and infrastructure damage, as well as in those that can be used to assess and repair damaged structures.

The use of fibre-reinforced plastics (FRPs) is considered to be a key technology for column and shear wall reinforcement, and is currently being investigated as an effective means of retrofit following an earthquake. The proper composition and optimal installation of this technology are the focus of an ongoing intensive research collaboration between Taiwan's NCREE (see box) and Carleton University.

The Taiwanese have also identified fire research and building performance as priority issues, as evidenced by the extensive construction of new large-scale research facilities in Tainan. While many of these facilities are similar to those at NRC, the Tainan facilities also include a 29-metre-high test area for atrium smoke management research, as well as a beam, slab and column furnace that can be used to investigate the structural fire performance of multiple building elements simultaneously.

In addition, ABRI is in the process of building small- and full-scale volatile organic compound (VOC) emission chambers, as well as full-scale acoustics facilities, a heat resistance of building materials facility and large-scale facilities for assessing wind-driven rain, including that produced by typhoons.

The National Cheng-Kung University's department of architecture in Tainan is structured like IRC's Indoor Environment Program, with facilities for research on emissions, including VOCs, and workstations located in a controlled laboratory for studying occupant comfort and satisfaction.

Because Taiwan imports 97% of its energy resources, with the building sector accounting for 18% of the total consumption, there is a strong incentive to improve the energy efficiency of buildings. And because the climate is hot and humid, the emphasis is on cooling efficiency and electrical load reduction. Other "green" technologies research includes:
- the use of shading systems to reduce thermal loads through windows and building entrances;
- the evaluation of solar-power systems;
- the use of building waste water to provide green spaces; and
- the construction of a pilot plant to develop recycled building materials.

The trip provided clear indications of Taiwan's ongoing commitment to research in areas of building science that parallel NRC's, opening the door to future collaboration between the two countries.

To view the proceedings of the Workshop, please go to http://www.ncree.org.tw/2004tcworkshop/.

What we're hearing

FIATECH demonstrates innovation in construction

At the FIATECH spring conference, results from projects that have introduced innovations into the construction process were presented. FIATECH, of which IRC is a member, is a consortium of companies and organizations interested in capital construction, with a particular focus on the development and deployment of fully integrated and automated technologies for the construction industry (see previous article in *Construction Innovation* Volume 7, Number 2).

There are several projects underway, including the Smart Chip project, which is investigating commercially-ready technologies that can be easily adapted for construction applications. Two of its successful pilot projects were highlighted.

The first involved the placement of smart chips in newly poured concrete to predict real-time strength, using the concrete maturity method (in parallel with traditional quality control methods). The high levels of predictability found in the project suggest that this approach may replace the need for concrete slump tests on construction sites.

The second successful pilot project used smart chip tags on steel piping to reduce loss of materials and speed up access from on-site storage yards. A portable reader was used to track the location of the pipe anywhere on the site. In addition, it was shown that each piece of pipe could be registered in the system simply by driving a truck loaded with the pipe through a portal system at the entrance to the construction site.

Both of these pilot studies are generating significant interest from technology and equipment suppliers, and both demonstrate a great potential for improving productivity in the construction sector through innovation.

For more information about FIATECH, visit the Web site at http://www.fiatech.org.

IRC's intermediate-scale furnace: a promising new tool that could reduce costs of fire-resistance testing

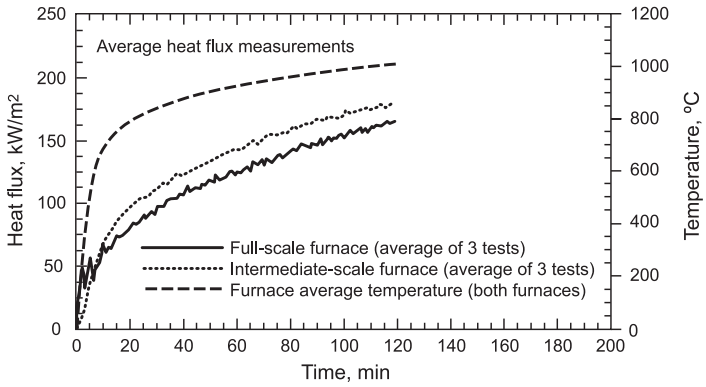
Continued from page 4

an assembly. This could result in significant savings for practitioners, as the cost of an intermediate-scale test is about 33% that of a full-scale test.

To ensure that the intermediate-scale furnace is able to provide results comparable to those of a full-scale furnace, a study was carried out that involved exposing the specimen to heat, using propane-fired horizontal and vertical furnaces of different sizes. The results showed the effect of the fire on the test specimens in the intermediate-scale furnace to be slightly higher than in the full-scale furnace (see figure). IRC researchers will continue to study the results obtained from full-scale and intermediate-scale furnaces to determine more precisely the correlation between them.

In the meantime, the intermediate-scale furnace has already demonstrated its usefulness as a screening tool in two major IRC projects: one examining the effect of specific design parameters, such as the application of insulation materials in the floor cavity, on the fire resistance of lightweight floor assemblies, and another evaluating the effects of insulation type and thickness on the behaviour of concrete slabs strengthened with fibre-reinforced polymers (FRPs) in fires. The intermediate-scale facility allows the researchers to perform—relatively inexpensively and quickly—parametric comparisons of assemblies, identifying the most promising solutions, which can then be tested at full scale to verify their acceptability.

Heat exposure of a full-scale furnace compared to that of an intermediate-scale furnace



For further information about the intermediate-scale furnace facility, please contact Dr. Mohamed Sultan at (613) 993-9771, fax (613) 954-0483, or e-mail mohamed.sultan@nrc-cnrc.gc.ca.

Upcoming events

CROSS-CANADA SEMINAR SERIES

Building Science Insight

http://irc.nrc-cnrc.gc.ca/bsi/2004

Seminar Series – 2004
Building a Better Cubicle
Cost-effective office design

Organized by:
Institute for Research in Construction
National Research Council Canada

For more information about this Seminar see page 2 of this issue.

October	November	December	January, 2005
Fredericton, October 13	Edmonton, November 1	Ottawa, December 2	Sainte-Foy (French),
Charlottetown, October 15	Yellowknife, November 3		January 18, 2005
St. John's, October 18	Winnipeg, November 5		Montreal (French),
Halifax, October 20	Toronto, November 8		January 20, 2005
	Whitehorse, November 16		
	Vancouver, November 18		
	Vancouver, November 19		
	Calgary, November 22		
	Saskatoon, November 24		
	Toronto, November 26		

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OCTOBER

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Asset Management: Planning and Reporting Options for Water Utilities. Dallas, TX. http://www.awwarf.org/newsAnd Events/calendar/agenda/dallas/index.aspx

NOVEMBER

14-17

AWWA Water Quality Technology Conference and Exposition (WQTC). San Antonio, TX. http://www.awwa.org/conferences/wqtc/

DECEMBER

1-3

Construct Canada '04. Toronto. www.constructcanada.com

2005
MARCH

14-18

Efficient 2005. 3rd International Conference on Efficient Use and Management of Water. Santiago, Chile. http://www.efficient2005.com/

MAY

12-13

Roofing Symposium. Cool Roofing…. Cutting through the Glare. Atlanta, GA. Contact: Catherine Moon at 1 800 828-1902; http://www.rci-online.org/downloads/RCIF-Cool-Roof-Symp-Papers-Call.pdf

JUNE

2-4

33rd CSCE Annual Conference 2005. Toronto. Call for papers: abstracts due October 15, 2004. www.csce2005.ca

This calendar does not include all events scheduled to take place during this time frame. For a more complete listing, see the Web version of "Upcoming events" at http://irc.nrc-cnrc.gc.ca/events.html

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