NRC·CNRC
Institute for Research in Construction

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construction innovation

NRC-CCCT in London hosts Building Information Modeling (BIM) experts

Construction stakeholders recently joined staff of the NRC Centre for Computer-Assisted Construction Technologies (NRC-CCCT) in London, Ontario for a one-day workshop to discuss the use of Building Information Modeling (BIM) technology in the industry.

The event, consisting of presentations from both researchers and industry professionals, included a general overview of BIM (see box, page 11), and highlighted current research, work and initiatives within the industry.

Pierre Boucher, chief operating officer of the Canadian Construction Association (CCA), discussed innovation and procurement in construction, and the role and responsibilities of CCA in the implementation of BIM. He also outlined the current CCA and NRC Industrial Research Assistance Program initiative to stimulate R&D in construction.

A long-time user of BIM in his architectural practice, Paul Loreto, chair of the Canada BIM Council (CBC), presented a case history of a BIM-administered hospital project that demonstrated significant time and cost savings. Mr. Loreto cited BIM as a key architectural visualization, design, documentation and facilities management tool, especially when working with tight schedules and budgets. He said buildings created using BIM technology can be developed thirty percent faster and at much lower cost than projects developed without it. Mr. Loreto acknowledged CBC needs to address issues such as standards and interoperability (the exchange of data from one system to another).

Facility management experts, architects, engineers and construction contractors (AEC), and related academics shared their experiences and views on BIM implementation, its uses, benefits, and associated challenges such as integration and interoperability. While BIM has been used for front-end activities such as bid preparation and design activities, it is evident that contractors and the professions are adopting BIM at all stages of construction.

Participants discussed specific applications of BIM during an afternoon roundtable. These include visualization of designs, energy analysis, pre-fabrication of components, structural analysis, design conflict resolution, asset management, air flow and lighting analysis, and the generation of construction specifications. The ability of BIM to serve as a backbone for intelligent buildings and BIM convergence towards Leadership in Energy and Environmental Design (LEED) were also mentioned.

Addressing BIM adoption, attendees agreed that the construction industry requires integration tools to visualize models, analyze data, and communicate with each other. These

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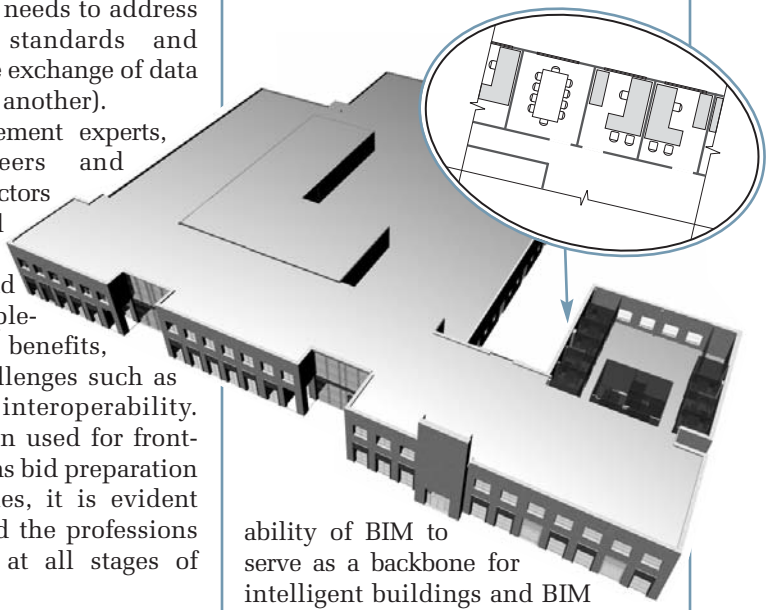
Highlights



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Canada

New harmonized window standard to be referenced in 2010 National Building Code

A new, harmonized performance standard for windows, doors and skylights has been developed and will be referenced in the 2010 National Building Code of Canada (NBC), replacing a number of Canadian standards, some of which were outdated. The standard is AAMA/WDMA/CSA 101/I.S.2/A440, *NAFS – North American Fenestration Standard/Specification for Windows, Doors, and Skylights*.

Revisions to the NBC were recommended by a Canadian Commission on Building and Fire Codes (CCBFC) task group. The task group reviewed the harmonized standard to determine its consistency with the scope and objectives of Parts 5 and 9 of the NBC and its performance levels with respect to currently referenced documents. The resulting proposed changes went to public review in fall 2008 and were subsequently approved by the CCBFC.

In the 2010 NBC, Part 5 will contain a new subsection to ensure consistent application of the requirements and compliance procedures. In Part 9, a single new section on windows, doors and skylights will replace the current sections for doors and windows. Prescriptive requirements have been updated to reflect the harmonized standard, and performance requirements were added, including some for minimum thermal performance targets.

Builders, engineers and consultants will need to learn a new

Continued on page 3

New award for outstanding contribution to the Canadian Commission on Building and Fire Codes

The NRC Institute for Research in Construction (NRC-IRC) has established a new award honouring volunteers who have made an exceptional contribution to the Canadian Commission on Building and Fire Codes (CCBFC). It was named after the current CCBFC Chair, Bruce Clemmensen, who is also the first recipient. The award was presented to Mr. Clemmensen at the CCBFC meeting in Toronto on February 21, 2010.

Mr. Clemmensen was honoured for his excellent leadership during his 13-year tenure as CCBFC Chair (from September 1997 to September 2010). He guided the Commission at a time when the National Construction Codes were undergoing a major change—from being largely prescriptive in nature to documents based upon clearly stated objectives. The 2005 editions of the codes, re-cast in an objective-based format, provided greatly expanded information that clearly stated the scope and purpose of requirements. It made them easier to understand when proposing or evaluating alternative solutions.

Mr. Clemmensen also led the Commission in the establishment of a strong partnership with the provinces and territories and in the advancement of the national code development system, which is captured in the 2009 CCBFC Policies and Procedures.

One of Mr. Clemmensen's greatest strengths is his ability to encourage stakeholders to work together for the common good. That ability was demonstrated not only in his work strengthening the partnerships with the provinces and territories, but also in championing consensus among stakeholders with differing interests, and in soliciting input on code issues at meetings here and abroad.

It is through the selfless dedication and exemplary leadership of volunteers like Mr. Clemmensen, that the CCBFC is able to make a vital contribution to Canadian's built environment, leading the progressive development of Canada's national model construction codes and ensuring their suitability for adoption by provincial and territorial governments.

Gordon L. Walt Award

An award similar to the Bruce Clemmensen Award recognizes meritorious and longstanding service in support of the Canadian Commission on Construction Materials Evaluation (CCCME). Created in 1999, the Gordon L. Walt Award was named for the founding manager of the NRC Canadian Construction Materials Centre. The first recipient was Fred Nicholson, Chair of the CCCME. It was also awarded to three Commission members: Ali Arlani, Art Kempthorne, and Jack Robertson.

Continued from page 2

procedure for specifying windows, doors and skylights, as the current A, B, and C rating system used by the 2000 edition of CSA A440 is being replaced with actual design load and pressure ratings. In addition, performance grades for windows, doors, and skylights will need to be selected according to the CSA's Canadian Supplement (CSA A440S1, *Canadian Supplement to* AAMA/WDMA/CSA 101/I.S.2/A440, *NAFS – North American Fenestration Standard/Specification for Windows, Doors, and Skylights*), also referenced in the 2010 NBC, to ensure the fenestration products are appropriate for the conditions and geographic location in which they are installed.

The harmonized fenestration standard, substantially different from its predecessors, is supported by industry in both Canada and the United States, as it will help reduce production and marketing costs.

For more information, visit the national codes website at **www.nationalcodes.ca** or contact Frank Lohmann at 613-993-9599 or frank.lohmann@nrc-cnrc.gc.ca.

Historical Codes available online

Historical editions of the National Model Construction Codes, used as models for virtually all building, plumbing and fire regulations in Canada, are now available. You can access the entire English and French Codes collections from the first edition in 1941 all the way to 1995 with the purchase of a single subscription.

To order, visit NRC's virtual store at **www.nrc.gc.ca/virtualstore**.

Improving resistance of light wood-frame buildings to lateral loads

Ensuring that buildings can adequately resist lateral loads from natural hazards is a key consideration of the National Building Code of Canada (NBC), particularly in British Columbia where the threat of a strong earthquake is high. Damage from earthquakes in California and Japan over past decades indicates that light wood-frame buildings must have walls that are properly constructed and connected in order to provide an acceptable minimum performance under earthquake loading. This, coupled with significant changes in design and construction of light wood-frame buildings since the 1960s, has led to a review of the simple prescriptive structural requirements in Part 9 of the 2005 NBC, with respect to both seismic and wind loads.

For areas where the risk is low-to-moderate, no new requirements have been added.

Three years ago, a task group established by the Canadian Commission on Building and Fire Codes (CCBFC) examined the requirements. The group used available information from Canada and the United States, as well as findings from past earthquake surveys and a suite of full-scale earthquake simulation tests that were performed on houses in Canada, the United States, China and Japan. The task group's proposed changes, which went to public review in fall 2008, were accepted by the CCBFC and will be incorporated into the 2010 NBC.

The recommendations include introducing a risk-based approach with three risk levels (low-to-moderate, high, and extreme) for exposure to wind and seismic forces, using environmental load data in the 2010 NBC Appendix C. For areas where the risk is low-to-moderate, no new requirements have been added. In a limited number of regions of extreme risk, engineering design according to NBC Part 4 is required.

The bulk of the new requirements, however, apply to areas of high risk, mainly the Pacific coast of British Columbia. For these areas, prescriptive requirements have been added to NBC Part 9 so that builders can incorporate adequate lateral load resistance without the need for structural engineering design. These include constructing walls using braced wall panels in braced wall bands that are continuous horizontally and vertically throughout the building and extend from the top of the supporting foundation, slab or sub-floor, to the roof framing above.

Limits and requirements are also in place for materials, spacing and dimensions for braced wall bands and braced wall panels, as well as fastening and framing details. In high wind areas, there are additional requirements for attaching roof sheathing to framing and roof framing to walls.

For more information, visit the national codes website at **www.nationalcodes.ca** or contact Frank Lohmann at 613-993-9599 or frank.lohmann@nrc-cnrc.gc.ca.

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Workshop assesses impact of objective-based and performance-based codes

The impact of objective-based and performance-based codes was the focus of a September 2009 workshop hosted by the NRC Institute for Research in Construction (NRC-IRC) in Calgary. Fifty participants from Canada and 18 other countries, representing a wide spectrum of stakeholders in construction, shared experiences and lessons learned in adopting and using such codes.

The real impact of objective- and performance-based codes on innovation has not yet been fully realized. Many countries still depend largely on prescriptive requirements. Despite the lack of quantitative evidence, there was anecdotal evidence of innovation. Several countries pointed out that the new codes facilitate harmonization, across national and international jurisdictions, by providing greater language clarity and consistency and a better understanding of the codes' goals and intents.

Participants agreed that the transition to objective- and performance-based building codes is still unfolding worldwide and will probably take another generation before its benefits are fully realized.

A common observation regarding the new codes was that proposed alternative solutions were more difficult to assess and evaluate for compliance. The processes for securing approval of a novel solution were variously described as time-consuming, burdensome, complex, and unfamiliar for the parties involved. As a result, many jurisdictions have experienced a growing demand for independent quantitative assessments or tests to evaluate the true performance of alternative solutions. Some participants pointed to the need for better documentation of alternative solutions at the national level, so that innovation benefits could be experienced more broadly. Others called for a process for assessing and adding these solutions to acceptable or deemed-to satisfy sets referenced by the codes.

Many jurisdictions said that using performance- and objective-based codes required a higher level of sophistication on everyone's part, and better training and educational materials. Some countries have seen an increase in the number of certified third-party assessors with the authority to approve new buildings and projects. Canada itself has seen an increase in private consulting services assisting builders and designers in obtaining approvals for novel solutions and demonstrating their compliance with the new code requirements. Other jurisdictions have imposed stronger requirements for the certification of building inspectors and practitioners.

Participants agreed that the transition to objective- and performance-based building codes is still unfolding worldwide and will probably take another generation before its benefits are fully realized.

Some countries have seen an increase in the number of certified third-party assessors with the authority to approve new buildings and projects.

The workshop comprised members of the Inter-Jurisdictional Regulatory Collaboration Committee and the World Federation of Technical Assessment Organisations as well as representatives of the Canadian Commission on Building and Fire Codes, the Provincial Territorial Policy Advisory Committee on Codes, Canadian building regulatory officials and manufacturers, and Canadian building associations and standard organizations.

NRC-IRC Housing Report

Available soon on the NRC-IRC website
www.nrc-cnrc.gc.ca/eng/ibp/irc/publications/index.html

A Summary of NRC-IRC Housing Activities for 2009: A Report Prepared for the Canadian Home Builders' Association

This report summarizes NRC-IRC housing-related activities for the year 2009, including research, code development and product evaluation. A short description of each activity is given, often with links to web pages for further information or detailed reports. The report was prepared for the 2010 annual conference of the Canadian Home Builders' Association.

Business review survey offers insights on NRC-CCMC services

Results from an online survey of Canadian building officials and manufacturers are already yielding important insights on the services offered by the NRC Canadian Construction Materials Centre (NRC-CCMC). The survey, part of the NRC-CCMC business review (see *Construction Innovation*, June 2009), was conducted from August 19 to October 10, 2009. It was completed by 229 building officials and 54 manufacturers.

There was agreement that if NRC-CCMC were to consider expanding the scope of its services, it should include energy efficiency, water conservation, and sustainability.

One of its major findings was that building officials rely heavily on NRC-CCMC's evaluation listings and reports to approve standardized and innovative products. Most respondents noted that they lacked the time or expertise to properly review all the documentation necessary to approve such products and that the impartial and credible opinions in the listings and reports were extremely useful in helping them make decisions.

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Manufacturers expressed concern about the length of time required for NRC-CCMC evaluations, though this did not appear to be an overriding issue for building officials. The two groups also differed on the appropriateness of the current three-year report re-evaluation cycle and a proposed five-year cycle. Awareness about the changes introduced in the new NRC-CCMC report format (see *Construction Innovation*, June 2008) was low in both groups. Those who were aware, however, said that the new format was an improvement. There was agreement that if NRC-CCMC were to consider expanding the scope of its services, it should include energy efficiency, water conservation, and sustainability.

Both building officials and manufacturers were generally unaware of the quality control and installation manual reviews carried out by NRC-CCMC as part of its evaluations. Many were also not aware of the existence of the preface to evaluation listings and its importance. The biggest revelation, however, was the degree of confusion exhibited by both groups on the difference between listings (for standardized products) and reports (for innovative products). These observations all point to a need for better communication.

These findings appear to support views obtained from focus groups held across the country in fall 2009. Once the business review is completed in March 2010 and the final report is reviewed and analyzed, NRC-CCMC will have a clearer idea on the direction it needs to take to better meet client needs.

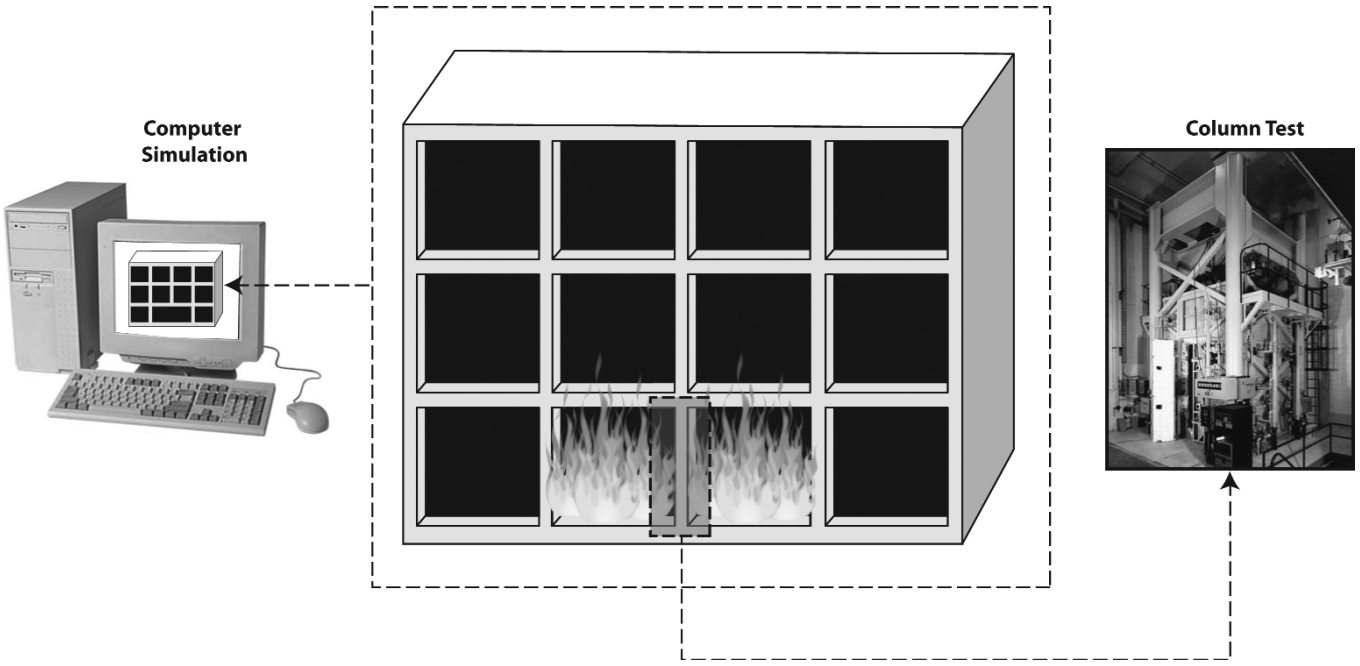
For more information, contact John Flack at 613-990-8518 or john.flack@nrc-cnrc.gc.ca.

New product evaluations from NRC-CCMC

Company	Product Name	CCMC #	Description
CertainTeed Corporation	Restoration Millwork Exterior Trim	13385-L	Vinyl Siding, Soffits and Fascia
National Gypsum Company	Gold Bond® BRAND e²XP™ Extended Exposure Sheathing	13439-L	Glass Mat Gypsum Board
Fomo Products Incorporated	Handi-Foam® Two-Component Spray Foam	13455-L	Bead-Applied Two Component Polyurethane Air Sealant Foam
Georgia-Pacific Chemicals LLC	Resorsabond® GP 4200 and GP 7200 series resins with Hardener Resorsabond® GP 4568	13458-L	Wood Adhesives

For further information on the performance, usage and limitations of these products, as well as for other reports and listings by NRC-CCMC, see the Web Registry of Product Evaluations located at **www.nrc-cnrc.gc.ca/eng/services/irc/ccmc/registry-product-evaluations.html**.

NRC-IRC develops new approach for structural fire resistance



A new hybrid structural fire resistance testing technique is being performed at NRC-IRC facilities. The diagram shows testing of a column (pictured at right) coupled with the remainder of the structural frame (computer-simulated at left).

Fire resistance testing provides a means of determining whether or not building elements or assemblies meet minimum performance criteria set out in building codes. Traditionally, fire resistance rates have been measured using a prescriptive test method, which assesses the performance of individual building elements with no consideration to the interaction with the structural system of the whole building. Building elements, such as beams and columns, are tested separately from other structural elements.

The problem with this approach is that it uses a constant load on elements being tested. Research has determined that the load increases during a fire. Furthermore, lateral deformation of the elements has been observed due to floor thermal expansion, which is not considered in the present test method.

Industry and university partners are being sought to collaborate in the research to develop this new approach for determining structural fire resistance.

To address this issue, NRC-IRC is investigating a new approach that will consider the effects on a whole building, rather than just individual elements, by using computer simulations. This new approach will initially be applied and verified for use in estimating the fire resistance of reinforced concrete columns, within a building frame, taking into consideration the effect of the structural system, thermal expansion and lateral loads. The concrete columns will be tested with the remainder of the structural frame being computer-simulated.

Industry and university partners are being sought to collaborate in the research to develop this new approach for determining structural fire resistance. For more information, please contact Hossein Mostafaei at 613-993-9729 or hossein.mostafaei@nrc-cnrc.gc.ca.

Keeping buildings dry from the outside in

A lack of cavity drainage behind cladding is a major concern for those in the construction industry. Water can become trapped within these small and narrow drainage spaces, which may lead to the premature deterioration of the building envelope. Trapped moisture may not be adequately managed by drying alone, and may cause damage that is detrimental to the long-term performance of the wall system.

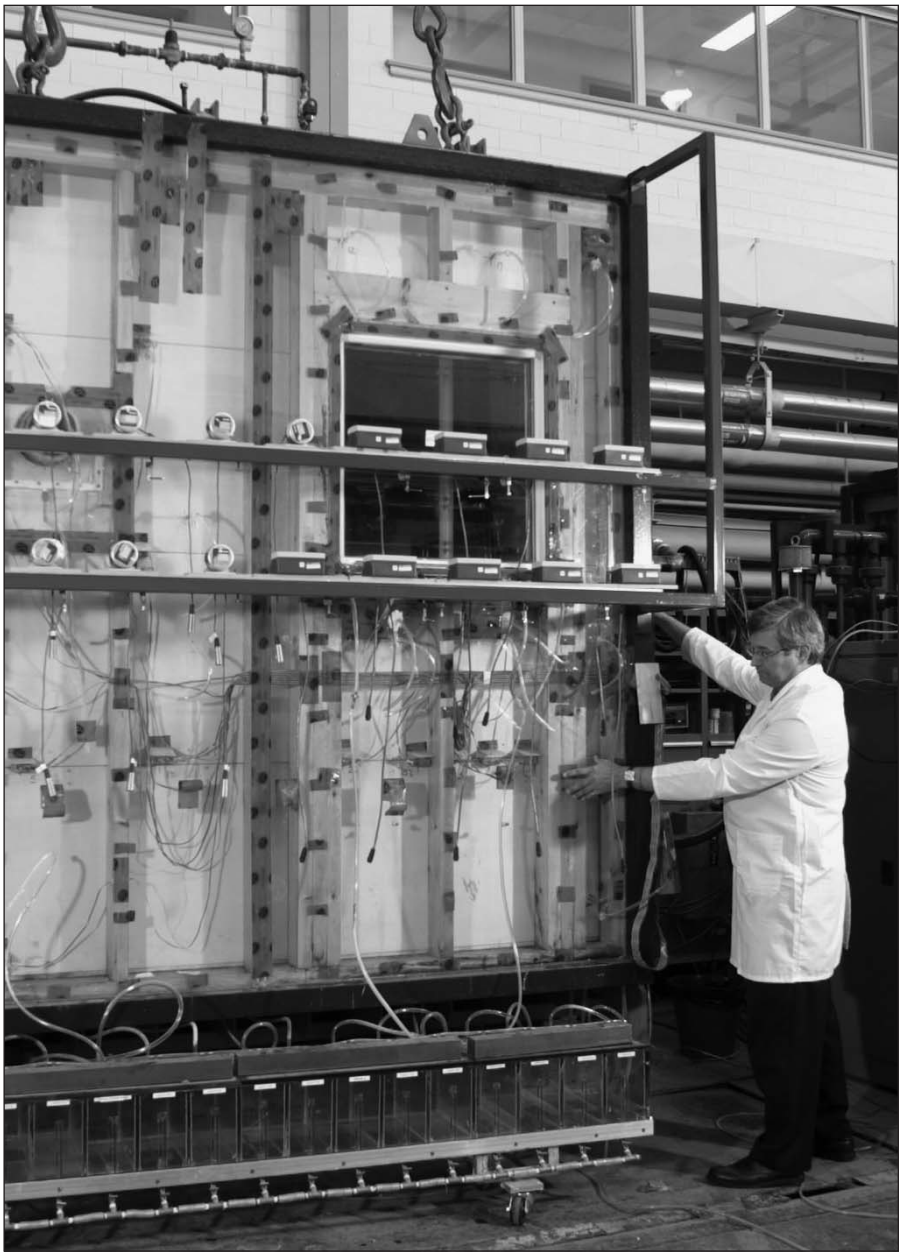
Drainage components combined with sheathing membranes are increasingly being used behind cladding as a means of managing water ingress and enhancing drying – but to what extent do these components contribute to the overall long-term performance of the wall?

The study will develop guidelines for the selection and use of membranes and drainage components…

The NRC Institute for Research in Construction (NRC-IRC) and the Air Barrier Association of America (ABAA) are working on a collaborative research project to evaluate the performance of proprietary drainage components and sheathing membranes over the life of the wall assembly, when subjected to a range of climatic effects as might occur across North America.

The study will develop guidelines for the selection and use of membranes and drainage components in selected wall assemblies for specified climate zones based on their drainage and drying potential.

Results of the collaborative study will also be used by the NRC Canadian Construction Materials Centre (NRC-CCMC) to develop a product evaluation guide for installation of drainage components combined with sheathing membranes applicable to low-rise, wood-frame construction.



Michael Lacasse, senior research officer at NRC-IRC, works on a wall test specimen to evaluate water tightness and drainage performance of wall components.

Both public and private organizations interested in improving the water management performance of wall assemblies are invited to join this three-year project expected to begin in May 2010.

For more information, visit the website at **www.nrc-cnrc.gc.ca/eng/projects/irc/sheathing.html**. Questions can be directed to Dr. Michael Lacasse at 613-993-9715, michael.lacasse@nrc-cnrc.gc.ca.

Protecting critical concrete infrastructure against extreme shocks

The effect of extreme shocks on critical public infrastructure induced by heavy truck impact or blasts is a growing concern. Effective protection systems to ensure the safety and security of the public need to be developed to address this problem.

The NRC Institute for Research in Construction (NRC-IRC) has embarked on a new four-year research project designed to strengthen and enhance concrete bridge structures. It will focus on the use of advanced fibre-reinforced polymers (FRPs) to protect critical concrete infrastructure against extreme shocks.

The study is part of the NRC's cross-institute Advanced Materials Initiative in concert with partners that include the NRC Industrial Materials Institute, NRC Institute for Aerospace Research, and the University of Ottawa.

The proposed new system will help concrete infrastructure absorb the considerable impact induced by extreme shocks over a short period of time. It will distribute any concentrated impact across the infrastructure, thus reducing the damage. The system will increase the robustness of critical infrastructure components and reduce their risk of failure when subjected to a heavy truck impact or blast.

The focus will be on critical concrete columns that will be protected from the outside using thermoplastic FRP and shock-absorbing materials. Recent cost reductions make FRPs more economically viable as construction materials.

Optimization of the design and performance of concrete columns under extreme shocks will be developed using a multi-scale modeling approach. Research will involve computer modeling and lab testing to simulate the behavior of protected concrete columns under impact and blast loads, and assess the structural efficiency of the proposed protection system.

For specific questions or interest in partnership for the project, contact Dr. Husham Almansour at 613-993-0129 or e-mail husham.almansour@nrc-cnrc.gc.ca.

Corrosion-resistant reinforcing steel in concrete structures

Corrosion of reinforcing steel is a major cause of premature deterioration of concrete structures, costing billions of dollars in maintenance and rehabilitation in North America. De-icing salts and sea water are the sources of chlorides that cause corrosion, which can be further compounded by the carbonation of concrete caused by carbon dioxide in air.

To address the challenges of increasing corrosion resistance and extending the service life of concrete structures, the NRC Institute for Research in Construction (NRC-IRC) and its partners (see box) have completed a project comparing the performance of a new type of corrosion-resistant steel, (ASTM A 1035) with conventional carbon steel, and stainless steels (316 LN, 304 LN and 2205).

Key findings included:

- ASTM A 1035 steel has a chloride threshold value (the critical chloride concentration above which the steel will begin to corrode) four to five times higher than that of carbon steel.
- Resistance to carbonation of concrete is higher than that of carbon steel.
- Resistance to pitting corrosion is higher than that of carbon steel.
- Corrosion resistance is reduced when the surface is covered with mill scales (iron oxides).
- Corrosion resistance is lower than the three types of stainless steel.
- Coupling corrosion rate between two ASTM A 1035 steel bars is lower than that between a carbon steel bar and an ASTM A 1035 steel bar.

A new project is being developed to determine how the use of ASTM A 1035 steel will affect the service life and life cycle cost of reinforced concrete structures compared with using other steels. The proposed research will take into account the corrosion performance of ASTM A 1035 steel as obtained in the recently completed project. It will focus on its higher chloride threshold value and its lower corrosion rate, as compared to carbon steel. Further investigation is also needed on the effect of mill scales (iron oxides) on the corrosion performance of ASTM A 1035 steel and its impact on the service life of reinforced concrete.

For further information about the project, or to explore the possibilities for collaboration, please contact Dr. Jieying Zhang at (613) 993-6752 or jieying.zhang@nrc-cnrc.gc.ca.

Research Partners

- Alberta Infrastructure
- British Columbia Ministry of Transportation
- Manitoba Infrastructure and Transportation
- Ontario Ministry of Transportation
- Saskatchewan Department of Highways and Transportation

Collaborative project developing new software for automated analysis of sewer CCTV inspection records

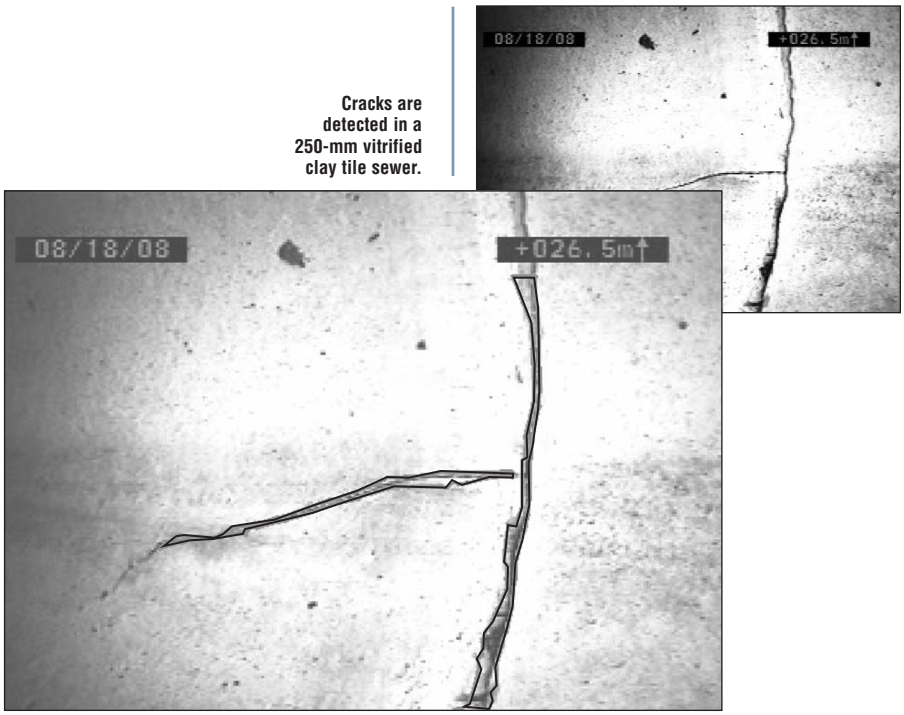
The NRC Centre for Sustainable Infrastructure Research (NRC-CSIR) in Regina is collaborating with the University of Regina and the City of Regina to develop software that employs image processing and feature recognition techniques to automatically analyze closed circuit television video records.

Accurate and reliable sewer condition data is the most critical requirement for proactive asset management, inspection planning, and renewal planning decisions. For over 30 years, Canadian municipalities have been using closed circuit television (CCTV) as the primary tool for sewer inspection and condition assessment. Canadian municipalities possess thousands of hours of archived CCTV video recordings that cannot be easily analyzed to extract meaningful condition data. Moreover, the CCTV-based sewer assessment process is known to be largely subjective and human-dependent, with potentially inconsistent results.

New software aims to improve the efficiency, consistency, and interpretation of the CCTV inspections by reducing the subjectivity typically employed during the inspection and assessment process. It will also enable the analysis of archived CCTV records to extract valuable historical condition information. This would support the development of reliable models to predict sewer deterioration.

The software implements a set of advanced image processing and computer vision algorithms for tracking and analyzing movement of the camera, frame classification and segmentation, as well as automated detection of structural and functional defects in sewers. Examples of such defects include longitudinal and circumferential cracks, fractures, tree root penetration, excessive deposits, and open or displaced joints. Once processing is complete, a report summarizing the position and type of defects is produced.

The software has been tested using a limited set of CCTV video files obtained from the City of Regina. Several extensions are currently underway to increase software capabilities including routines for estimating the severity of defects.



Cracks are detected in a 250-mm vitrified clay tile sewer.

The software has been tested using a limited set of CCTV video files obtained from the City of Regina. Several extensions are currently underway to increase software capabilities including routines for estimating the severity of defects. The software is also being interfaced with a GIS-based (geographic information system) sewer management system. The system will facilitate the storage, analysis, and management of sewer inspection and condition data in the context of an integrated asset management framework.

Municipal infrastructure stakeholders interested in participating in this project can contact Dr. Mahmoud Halfawy at 306-780-5396 or mahmoud.halfawy@nrc-cnrc.gc.ca.

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NRC London hosts Building Information Modeling (BIM) experts

Continued from cover

tools will enable users to make better decisions and predict potential issues.

Also discussed was the need to inform current AEC users about BIM technology and to provide structured teaching programs within universities and colleges. Industry associations and government also need to address BIM implementation. It was stressed that industry best practice guidelines and benchmarking capabilities need to be developed.

It is widely accepted that BIM has more potential than was first thought and Canadians are just scraping the tip of the iceberg. BIM's integration of metadata (other than geometry data) in digital models will improve and speed up the construction process, help find optimal solutions much earlier in the process, and serve as a repository throughout the life cycle.

The associations in attendance agreed there is a need to promote this technology. National BIM awareness and implementation initiatives are in progress. Early adopters have already experienced the benefits of BIM and would like to incorporate it into more of their work. Small- and medium-sized enterprises understand that they have to catch up with this fast approaching technology to stay competitive and provide solutions to clients.

For more information, please contact Shafee Ahamed at 519-430-7087 or shafee.ahamed@nrc-cnrc.gc.ca.

About Building Information Modeling

- Building Information Modeling (BIM) is a model-based technology for creating, co-ordinating, documenting and managing up-to-date information about a building and its components. It covers the building's complete life cycle, from commencement to decommissioning. Through BIM, a user has the ability to develop a "virtual building," in which all building elements are digitally created to fit together, comparable to the physical construction process.
- By providing continuous and consistent information, BIM, as an integrated methodology, helps the construction community to increase efficiency and reduce re-work and waste by streamlining change management. It serves as a platform for design, construction, procurement, operation and maintenance.
- BIM provides a platform to visualize the building design geometry in 3D, conventional 2D (plan and elevation) and sectional views. It provides the ability to illustrate projects in virtual environments where revisions can be shown in real time. It integrates with many other tools to provide advanced visualization. A benefit of BIM is the removal of repetition as BIM avoids re-entry of data (redundancy). Any change made to the BIM will reflect on all aspects of the construction (bi-directional associative).
- BIM serves as a repository of all the information relating to a building. It provides access and a way to update construction project information by users and provides a repository of the design intent, construction process and subsequent operation of the building. It serves as a common platform and communication solution to multiple tradespeople. It offers benefits to all participants during the construction process as well as to facility managers who operate and maintain the buildings and to owners as a digital repository.

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Readers are advised that the series is now available exclusively on the NRC-IRC website at: **www.nrc-cnrc.gc.ca/eng/ibp/irc/ctus/ctus-index.html**.

Upcoming events

APRIL

20-21
2010 Acoustical Society of America combined with Noise-Con 2010, Baltimore, Maryland. http://www.inceusa.org/NC10/

21-22
Buildex Vancouver, the BC Construction Show / HomeBuilder & Renovator Expo, Vancouver. http://www.buildexvancouver.com/

MAY

5-7
First International Conference on Nanotechnology in Cement and Concrete, Irvine, California. http://www.trb.org/news/blurb_detail.asp?id=9750

8-11
Construction Research Congress, Edmonton. http://www.2010crc.com

10-13
CIB World Building Congress, Salford, U.K. http://www.cib2010.org/

12-15
NASCC: The Steel Conference and the 2010 Structures Congress, Orlando, Florida. http://www.aisc.org/form.aspx?ekfrm=18232

19-20
eSim 2010, Winnipeg. www.esim.ca

29-June 1
3rd Congress of the International Federation for Structural Concrete (FIB) and PCI Convention, Washington, D.C. http://www.fib2010washington.com/

JUNE

1-2
European Facility Management Conference, Madrid, Spain. http://www.eurofm.org/news.php?id=94

7-9
6th International Conference on Concrete under Severe Conditions, Environment & Loading, Mérida, Yucatán, Mexico. http://www.consec10.com/index.php

16-18
International Conference on Performance-Based Codes and Fire Safety Design Methods, Lund University, Sweden. http://www.sfpe.org/Education/8thInternationalConferenceonPerformanceBasedCodesandFireSafetyDesignMethods.aspx

28-30
Second International Conference on Sustainable Construction Materials and Technologies, Ancona, Italy. http://www.uwm.edu/Dept/CBU/ancona.html

JULY

5-7
Interflam 2010, 12th International Conference on Fire Science & Engineering, Nottingham, England. http://www.intercomm.dial.pipex.com/html/events/interflam10cfp.htm

AUGUST

28-31
ASCE Pipeline Conference 2010, Keystone, Colorado. http://content.asce.org/conferences/pipelines2010/call.html

SEPTEMBER

13-15
1st Central European Symposium on Building Physics, Cracow, Poland. http://www.cesbp2010.p.lodz.pl/

22-24
2nd Historic Mortars Conference, Prague, Czech Republic. http://www.itam.cas.cz/HMC2010

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