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NRC · CNRC

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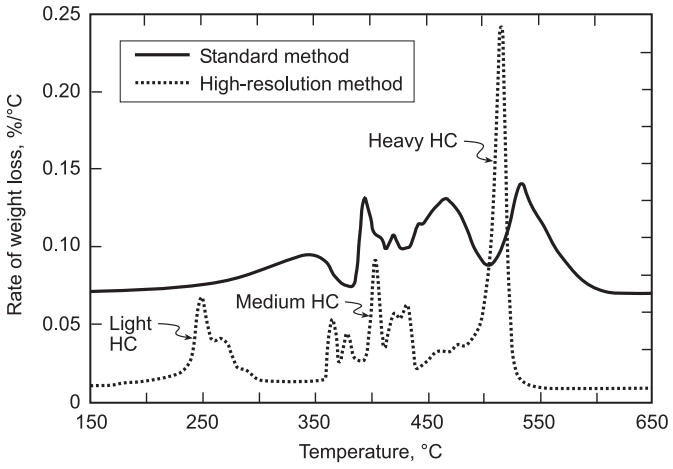
Bitumen fingerprinting allows for improved product consistency

Everyone has heard of DNA fingerprinting. It is the analysis of characteristic patterns in DNA to identify individuals. Now take the same idea and apply it to bitumen, the tar-like mixtures of hydrocarbons derived from petroleum naturally or by distillation. It may not sound as interesting or as high-tech, but researchers in IRC's Urban Infrastructure Program are finding that the process of "bitumen fingerprinting" they have developed is quite a handy tool.

Bitumen is an important component in a number of construction materials used for road surfacing and roofing, including polymer-modified asphalt, crack sealants, shingles and waterproof membranes. In each application, the bitumen is blended with a polymer, which can be a tricky process. There is always the possibility the mixture will separate, so once manufacturers have a mixture that works, they want to stick with it.

Unfortunately, the precise identity of bitumen is difficult to establish, so that two different lots with the same technical grade may have different chemical compositions. Although methods exist to analyze the composition of bitumen, they all use organic solvents that are expensive to use and to discard.

IRC researchers, however, have come up with a solventless method to fingerprint bitumen to ensure that bitumen products are consistent. It relies on a burning process called thermogravimetry (TGA), which is a method of controlled combustion that allows for measuring the temperature at which a material turns into ashes and gases. Because light, medium and heavy hydrocarbons (HC) in bitumen burn off at different temperatures, researchers can determine the chemical composition of a sample by monitoring changes in the sample's mass and the temperatures at which these changes occur.



Comparison of high-resolution and standard methods used to analyze a bitumen sample

Thermogravimetry has long been used to characterize petroleum products rapidly but has generally been plagued by poor resolution and reproducibility. The IRC researchers have overcome these difficulties, however, by using a combination of research-grade thermogravimetric equipment and a high-resolution method they have developed based on a patented algorithm. The result is improved resolution and greater reproducibility in the chemical analysis of bitumen.

To test this method for your particular application, such as emulsions, paints or plastics, please contact Dr. Jean-François Masson at (613) 993-2144, fax (613) 954-5984, or e-mail jean-francois.masson @nrc-cnrc.gc.ca.

Highlights

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New window of opportunity opens for Canadian manufacturers

Recently, the British Board of Agrément (BBA), the U.K. counterpart of the Canadian Construction Materials Centre (CCMC), agreed that Canadian window manufacturers could go through the CCMC evaluation process to obtain BBA certification for their products. This is expected to speed the evaluation process for Canadian manufacturers trying to break into the U.K. market; it could also save them money by eliminating the duplication of efforts—in this case, the need to test in both the U.K. and Canada.

Canada Mortgage and Housing Corporation (CMHC) and Natural Resources Canada (NRCan) set this opportunity in motion with their success in promoting the construction of "Super E" homes in the U.K. using Canadian-made energy-efficient housing products. With up to 300 new homes being built using Canadian products, there was an urgent need for acceptance of Canadian windows.

For this acceptance, CMHC turned to the BBA, with which CCMC already had an agreement for cooperation (see box). Like CCMC, the BBA provides impartial, technical evaluations on the performance of building products and their compliance with building regulations.

The CCMC-BBA agreement builds on a 1996 liaison agreement between CCMC and the BBA to share assessment information in order to facilitate the mutual acceptance of building products.

To begin the process of acceptance, NRCan funded a study comparing U.K. and Canadian window standards, which was received favourably by the BBA. This led to a second study funded by CMHC and conducted by the BBA, which consisted of performing weathering tests (air permeability, wind load resistance and water tightness) on window specimens meeting the Canadian standard CSA A440-00, Windows, to see if they also conformed with the U.K. standards.

Even though this particular case involved the evaluation and acceptance of Canadian-produced windows…its success will help accelerate other Canadian products through the U.K. acceptance process.

From these test results, the BBA agreed that the two standards had a good deal of common ground and that a positive evaluation from CCMC could substantially reduce the work and cost involved in obtaining BBA approval. But for the time being, the BBA still requires that weathering tests be performed in the U.K., although this will likely change with time and good test results.

For the majority of the other required tests (safety and durability), however, alternatives to testing performed by the BBA are currently possible. Manufacturers may have the safety and durability tests required by the U.K. performed by a CCMC-recognized third-party organization in Canada. In some cases, they may just have to provide current evidence of conformity to a North American test conducted by one of these organizations.

Even though this particular case involved the evaluation and acceptance of Canadian-produced windows—building on the trust already established between the BBA and CCMC in their 1996 agreement—its success will help accelerate other Canadian products through the U.K. acceptance process. This case also reinforces CCMC's technical credibility with the BBA, which could lead to opportunities for cooperation with other European nations.

For more information on the BBA acceptance of Canadian windows, contact Caroline St-Onge at (613) 998-4625, fax (613) 952-0268, or e-mail caroline.st-onge@nrc-cnrc.gc.ca.

CCMC evaluations boost Canadian products abroad

The Canadian Construction Materials Centre (CCMC) offers a national evaluation service for all types of innovative construction materials, products, systems and services. The majority of these innovative products are bound for the Canadian market, but increasingly, CCMC helps manufacturers of products it has evaluated to gain acceptance in other markets.

CCMC evaluations lend technical credibility to a product that may speed its course through evaluation processes in other countries. In addition, CCMC is helping companies gain international acceptance for their products by entering into agreements to cooperate and share evaluation information with their counterparts in other countries. Liaison agreements are currently in place with the U.S., the U.K., South Africa, Israel, Japan and New Zealand.

CALL FOR CANDIDATES TO SERVE ON THE CCCME

The National Research Council (NRC) is seeking candidates to serve on the Canadian Commission on Construction Materials Evaluation (CCCME).

The CCCME was established by NRC to support innovation, technology transfer, productivity and competitiveness in the Canadian construction industry, and to enhance public safety in the built environment. It is responsible for providing policy direction on all matters pertaining to the operation of the Canadian Construction Materials Centre (CCMC), and for ensuring the reliability and quality of technical decisions and reporting.

CCCME members are appointed by NRC. Such appointments do not carry remuneration, but expenses incurred to assist in Commission meetings, typically held once a year, are reimbursed by NRC. The term of appointment is normally three years; members may be re-appointed for further terms subject to maintaining a reasonable degree of membership rotation. In order to provide an opportunity for the Commission to benefit from new ideas and different points of view, its policies and procedures stipulate that one third to one half of the membership may be changed every three years. Such a rotation is about to be conducted. **New appointments and re-appointments will be effective November 1, 2005.**

CCCME members are selected from a mix of backgrounds to ensure that the Commission can address both policy and technical issues in a manner representative of the different regions of Canada, sectors of the construction industry, and users of the evaluation, technical information and listing services offered by CCMC. **Members are expected to exercise broad objective judgements and are chosen for their individual interests and abilities rather than as delegates or representatives of any particular association or group**. They are not permitted to name alternates.

The Commission is currently seeking representation from the following sectors:

Regulatory: provincial, territorial and municipal building officials; municipal infrastructure administrators; and provincial ministries of transport;

Manufacturing: members of the private sector involved in the manufacture of building and infrastructure materials, products and systems;

Major users: architects, engineers, contractors, specification writers, and private and federal agencies with an ownership mandate;

General: those associated with the construction industry in an independent capacity, which may include independent research, testing and certification agencies.

Those interested in serving on the Commission should submit a resume with details of their personal history, by **January 31, 2005** to:

Mr. R.C. Waters, P. Eng.
Secretary, CCCME
National Research Council of Canada
Ottawa, Ontario K1A 0R5

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2005 National Model Codes coming soon

The 2005 editions of the National Building Code, National Fire Code, and National Plumbing Code are scheduled for publication in the summer of 2005. They will contain:

- technical changes;
- an improved structure to facilitate the incorporation of provincial and territorial administrative provisions;
- new information (objectives and functional statements) linked to each code provision in an objective-based format. (Intent and application statements for each code provision will be available in supplementary publications on CD-ROMs.)

After publication of the 2005 codes, NRC in collaboration with the provinces and territories will present seminars across Canada on the technical changes, starting in December 2005. The complete schedule and location of these seminars will be announced in a future issue of *Construction Innovation*.

In addition, training on the application of the new information in the objective-based codes will be made available. This training to facilitate the transition to the new format will be delivered by the provinces and territories.

The provinces, territories, NRC and Canada Mortgage and Housing Corporation have jointly funded the development of the transition training courses (one for each code) for regulatory officials, with the courses designed so that they can be adapted for use by other professional groups, such as architects and homebuilders. A contract has been awarded to Morrison Hershfield Ltd. to provide the training materials package by early 2005.

Further details on the objective-based codes and the training that will be offered are available at www.nationalcodes.ca.

Are you in the business of renovating buildings?

If so, one of the best ways to ensure Code compliance is to follow the advice contained in the *User's Guide – NBC 1995, Application of Part 9 to Existing Buildings*, which deals with the application of the NBC to existing housing and small buildings. For larger buildings, you can consult the *User's Guide – NBC 1995, Fire Protection, Occupant Safety and Accessibility (Part 3)*. Whether you're renovating, expanding, changing the occupancy of a building, or checking code compliance, these easy-to-read guides clearly explain the principles by which National Building Code (NBC) requirements should be applied to existing buildings. Included in the User's Guide dealing with housing and small buildings are more than 50 examples of typical problems that may arise when a building is renovated or its occupancy changed. The Guide suggests solutions, together with an explanation as to how the alternative design solutions were reached. Also provided are the intents of each and every Article in NBC Part 9.

The User's Guides are **available** for $47 each. You'll likely save yourself and your client many times this amount on your very next renovation project. Interested? ***Here's how to order!***

Fill out the order form enclosed in the middle section of this newsletter, or contact our Publication Sales department

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New water-mist fire-suppression system now available for industrial oil cooker protection

Not long ago, researchers in IRC's Fire Research Program successfully developed a water-mist fire-suppression system to protect industrial oil cookers with industry partner CAFS Unit Inc. (see *Construction Innovation*, Vol. 8, No. 3). Now they have two more successes to celebrate connected with that system, which has been named MistShield. These include the construction of a new test facility for use in studying and approving water-mist systems for industrial oil cooker protection and the product's successful completion of FM Global fire-testing protocols—the first time this type of technology has received such approval.

During the FM approval fire tests, the water-mist system demonstrated its excellent performance in extinguishing very large cooking oil fires in less than 12 seconds (the test standard requirement is 60 seconds).

Constructed specifically for MistShield's FM approval, IRC's new test facility includes five large industrial oil cooker mock-ups built in IRC's burn hall. During the FM approval fire tests, the water-mist system demonstrated its excellent performance in extinguishing very large cooking oil fires in less than 12 seconds (the test standard requirement is 60 seconds). The system also cooled large quantities of very hot cooking oil to below 200°C from its burning temperature in less than two minutes of water-mist discharge, without causing oil splashing outside the cooker, thus preventing re-ignition.

The MistShield water-mist system developed by IRC and CAFS Unit is able to effectively extinguish large-scale cooking oil fires.

This outstanding performance secured FM approval for MistShield, which is an essential step for a product to gain acceptance in the food processing industry. FM is the only organization that has such fire-protection standards for factories.

"This is the first time a water-mist system has been made available for industrial oil cooker protection, and it's good news for the industry," says IRC's Dr. Zhigang Liu, who led the project.

Specific questions about the water-mist fire-suppression system and its fire tests can be directed to Dr. Zhigang Liu at (613) 990-5075, fax (613) 954-0483, or e-mail zhigang.liu@nrc-cnrc.gc.ca.

To view the video clip of the water-mist fire-protection system extinguishing an industrial oil cooker fire, go to http://irc.nrc-cnrc.gc.ca/fr/mistoil.html

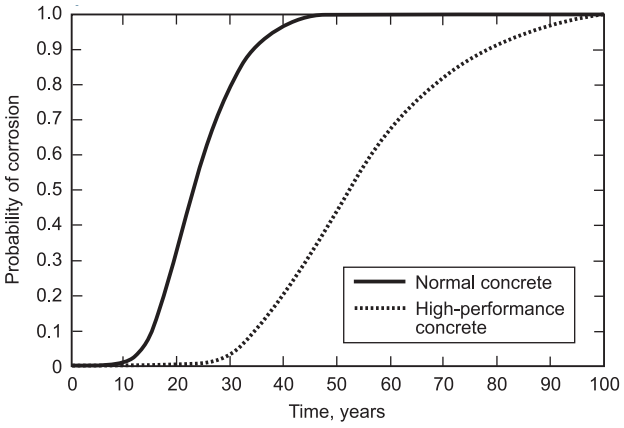
Latest Updates Now on IRC Web Site

We are pleased to announce that Construction Technology Updates 49–60 are now available on the IRC Web site. To access these publications as well as Updates 1–48, go to: http://irc.nrc-cnrc.gc.ca/catalogue/ctu.html

Please note that you can still purchase print copies of any Update by calling us at the numbers given on the Web site.

Researchers develop decision-support tools for life-cycle management of concrete bridge decks

Corrosion-induced damage of bridge decks results in excessive cracking and spalling in the concrete that leads to a loss of serviceability, ultimately affecting the structural safety of the bridge. The rehabilitation costs of deteriorated decks account for about one-third to one-half of total bridge maintenance costs in North America. It is therefore important to select a cost-effective design or rehabilitation strategy for a bridge deck that is based on a reliable estimate of its life-cycle cost. This requires an assessment of its service life at both the initial design stage, and under different protection treatments and rehabilitation strategies.



The figure illustrates the predictive capability of one of the models to provide the probability of corrosion, at any time, of the top layer of reinforcement. This reinforcement is made of conventional (carbon) steel.

An accurate prediction of a bridge deck's service life involves modelling the complex mechanisms of chloride transport, corrosion initiation, and damage initiation and propagation. Existing approaches and guidelines have serious limitations in addressing these requirements, which often result in predictions that have only limited reliability.

The life-cycle costing model allows all relevant costs associated with each protection, repair and rehabilitation strategy to be considered.

To address these limitations and to provide owners with effective decision-support tools for the life-cycle management of their concrete bridge decks, researchers in IRC's Urban Infrastructure (UI) Program and its partners (see sidebar) initiated a project to develop models that include both service-life prediction and life-cycle cost analysis modules. These modules have been developed and are being integrated into easy-to-use software with a graphic user-interface.

The models can predict the probability at any time of a deck reaching one of the five relevant limit states: chloride contamination, cracking, de-lamination and spalling of the concrete cover; and corrosion of the reinforcing steel. The software will provide the overall condition of the deck at any given time.

The life-cycle costing model allows all relevant costs associated with each protection, repair and rehabilitation strategy to be considered. These costs include those of design and construction, of approaches, of demolition and disposal, as well as the costs to users arising from detours, and traffic delays and accidents. The software will provide a ranking of the protection and rehabilitation strategies in terms of the present value of their life-cycle costs.

Software will benefit owners

In summary, the software incorporating these models will:

- enable users to undertake different types of simulations and sensitivity analyses to assess the impacts of different parameters on service life, life-cycle costs, and on the effectiveness of various protection and rehabilitation strategies;
- provide users with relevant information on the state of bridge decks, helping them better plan for their inspection, protection, repair, rehabilitation and replacement;
- help users, at the initial design stage, to select the most cost-effective system;
- contribute to an effective management of highway bridges;
- help improve safety, serviceability and durability of bridge decks at minimum (life-cycle) cost;
- constitute a step towards achieving a sustainable highway bridge infrastructure.

IRC researchers and consortium members will carry out validation testing of the Beta version of the software, which is to be released early in 2005.

For further information, please contact Dr. Zoubir Lounis at (613) 993-5412, fax (613) 952-8102, or e-mail zoubir.lounis@nrc-cnrc.gc.ca.

Project partners

Alberta Transportation, Cement Association of Canada, Cities/Regions of Hamilton, Ottawa, Winnipeg and Durham, Engineered Management Systems Inc., Federal Bridge Corporation Ltd., Manitoba Transportation and Government Services, Ministère des Transports du Québec, Nova Scotia Transportation and Public Works, Public Works and Government Services Canada

Mould workshop held in Montreal: report now available

A recent workshop on the economic, health and environmental issues associated with indoor mould contamination brought together both experts and stakeholders from fields such as health, construction, occupational health and safety, micro-biology and property management.

Over the past few years, there have been many stories in the newspapers about mould contamination in the indoor environment. They often point to mould as a cause of increased asthma, allergies and other ailments. But much of the evidence offered in these accounts has been anecdotal and/or based on information of varying quality.

To move discussion on the topic beyond these limitations, IRC, with its partners in the Healthy Indoors Partnership (see sidebar), put together a workshop that focused on two main areas related to mould in the indoor environment—the health effects of mould, and mould prevention and control—to identify the major issues, gaps and challenges, and to suggest measures for improvement.

"We felt it was important to bring experts and stakeholders together in the same place to interact and share knowledge," says Jim Robar, Director, Technical Research at the Canada Mortgage and Housing Corporation, who was on the workshop organizing committee. "This would allow experts to better understand stakeholders' needs and establish research priorities based on these needs."

In both areas, the participants identified the abundance of often-unreliable information as a source of problems. For health effects specifically, they also identified problems with the lack of standardized guidelines for investigation, clinical assessment, environmental sampling and laboratory testing; the lack of an accreditation system for practitioners at all levels; and the lack of clinical and fundamental knowledge about mould-related symptoms among health practitioners.

For mould prevention and control, the participants found the lack of standards equally problematic. In particular, they identified the need for recognized threshold levels for safe exposure to mould; and the need for standards, guidelines and best practices related to building construction and operation, building renovation and retrofit, and mould detection and remediation.

To begin addressing these challenges, the participants suggested developing an accreditation program for practitioners at all levels and educating the medical community on the health effects of mould. They also saw opportunities to increase the knowledge base through research in the following areas:

- the management of moisture in buildings;
- the impact, compatibility and integration of "green" solutions with current design practices and building systems;
- improved methodologies for detecting mould in buildings; and
- the environmental conditions favourable to mould growth.

The HIP's Strategic Research Committee has disseminated its workshop report and recommendations and is exploring the possibility of collaborative projects among HIP partners and other stakeholders, to move forward on the priorities established at the workshop.

Based on the success of this workshop, organizers are tentatively planning a second one for October 2005. For more information on the Montreal workshop, see the complete report at www.healthyindoors.com.

The Healthy Indoors Partnership

The Healthy Indoors Partnership (HIP) is a not-for-profit organization that brings together private, public and not-for-profit organizations and individuals to collaborate on common indoor environmental health issues in Canada. This collaboration focuses on four main areas: the consolidation and integration of research, the promotion of guidelines and best practices, the fostering of related programs in marketing, and education and outreach. In addition, the group provides a source of indoor environment information and resources, maintains a list of conferences and other events, and puts out a free newsletter to help members and supporters stay up to date on indoor environmental issues in Canada. For more information, visit the HIP Web site at www.healthyindoors.com.

Newsbrief

IRC initiates research on life-cycle analysis and sustainability of high-performance concrete (HPC) structures

The aging and deterioration of Canada's built environment, and the new requirements for greenhouse gas reduction coupled with the demands for energy efficiency and conservation, present technical and economic problems and challenges to designers, owners and managers of infrastructure and buildings. These problems are further compounded by the prohibitive and ever-increasing costs of maintaining and preserving Canada's urban infrastructure.

To address some of these challenges, IRC and its partners (see box below) have initiated a two-year project that will review the existing decision-support tools for life-cycle analysis and assessment of the sustainability of HPC structures, helping them to identify the research needs.

Over the last few decades, the use of HPC made with supplementary cementing materials (SCMs), such as fly ash, silica fume and blast furnace slag, has increased considerably in the construction, rehabilitation and replacement of infrastructure systems and buildings. Its use offers many advantages:

- greater strength, lower weight, lower permeability and longer service life;
- less need for cement, and for maintenance and repair, thereby reducing life-cycle costs;
- a reduction in greenhouse gas emissions and in the quantity of raw materials needed (cement and reinforcing steel), resulting in lower energy and users' costs;
- a positive impact on the environment, contributing to the sustainability of buildings and infrastructure.

For further information about the project, or to explore the possibilities for collaboration, please contact Dr. Zoubir Lounis at (613) 993-5412, fax (613) 952-8102, or e-mail zoubir.lounis@nrc-cnrc.gc.ca.

Project partners:
Researchers from IRC's Urban Infrastructure (UI), and Building Envelope and Structure (BE&S) Programs; Natural Resources Canada (Action Plan on Climate Change); and Public Works and Government Services Canada

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Montreal Holiday Inn Select, Midtown
420 Sherbrooke Street W.
Montreal, QC H3A 1B4

26-28
Workshop: Repair Mortars for Historic Masonry. Delft, the Netherlands. www.acmcentre.com/TCRHM

MARCH

9-11
International Building Lime Symposium. Orlando, FL. www.buildinglime.org

APRIL

5-7
Construction Research Congress 2005. San Diego, CA. http://www.constructioninst.org/conferences/crc05/index.cfm

10-12
AWWA Water Security Congress. Oklahoma City, OK. http://www.awwa.org/conferences/congress/

20-24
Structures Conference 2005. New York, NY. http://www.asce.org/conferences/structures2005/index.cfm

MAY

12-13
10th Canadian Building Science and Technology Conference. "Building Science and the Integrated Design Process." Contact: Duncan Hill at (613) 748-2984, http://www.nbec.net/conference/

12-13
RCI Foundation, NRC-IRC, ORNL present "Cool Roofing....Cutting through the Glare." Hyatt Peachtree Hotel, Atlanta, GA. http://www.rci-online.org/downloads/RCIF-Cool-Roof-Symp-Papers-Call.pdf. Contact: Catherine Moon, RCI Foundation, 1-800-828-1902

15-19
World Water and Environmental Resources Congress. Anchorage, AK. http://www.asce.org/conferences/ewri2005/

JUNE

1-3
McMat 2005: Mechanics and Materials Conference. Baton Rouge, LA. http://www.mcmat2005.eng.lsu.edu/

1-4
International Civil Engineering History Symposium (CSCE). Toronto. http://www.csce2005.ca/

8-12
10th Canadian Masonry Symposium. Banff, AB. www.ucalgary.ca/~tenthcms

12-16
AWWA Annual Conference & Exposition. San Francisco, CA. http://www.awwa.org/ace2005/

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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