Volume 6 Number 2 **Spring 2001**

construction innovation

NRC · CNRC

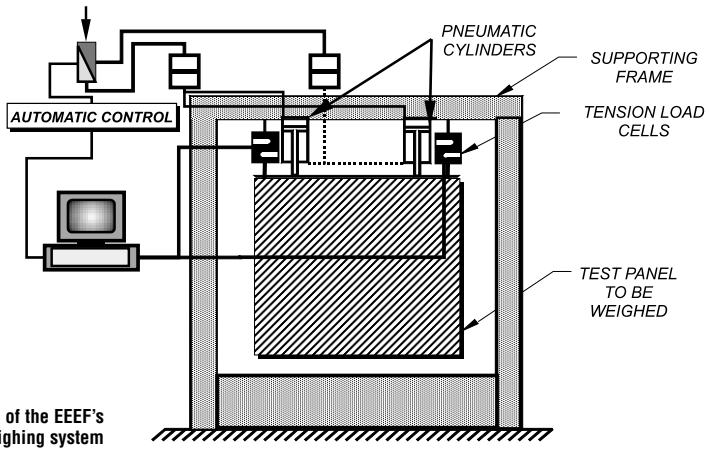
Unique new "weather machine" studies wall performance

IRC's Building Envelope and Structure Program has a new test facility that can monitor and weigh a full-scale wall assembly (2.4 m x 2.4 m), providing useful information about how walls dry out.

The climatic chamber, which is unique in North America, is known as the Envelope Environmental Exposure Facility (EEEF). It can simulate interior and exterior climatic conditions over extended periods of time, controlling both temperatures (ranging from -47 to +48°C) on the 'weather' side of the wall and humidity levels (ranging from 10 to 100% RH).

Researchers, in conjunction with key industry partners, are using the facility to benchmark the thermal and moisture performance of walls in various climates, and to study drying behaviour at the interfaces between walls and a) other building elements (such as windows) and b) service penetrations.

IRC researchers prepare full-scale wall specimen for a drying experiment in the Envelope Environmental Exposure Facility (EEEF)



Schematic of the EEEF's wall-weighing system

Already they have gathered key information about the drying rate of wood-frame wall components, which they are using to confirm the drying characteristics of the wall assembly predicted by a combined heat, air and moisture transfer model, hygIRC. These comparisons between experimental results and model predictions have provided insight into how water re-distributes itself within the wall before drying out.

The facility features several innovations:

- a weighing system that detects water evaporating from the wall by measuring the total wall weight with great precision (in grams) and tracking this weight over time;
- a frame and gasket technique for sealing the wall specimens to the enclosure, without interfering with the weighing process;
- state-of-the-art moisture meters for mapping differential drying on the face of the wall;

Continued on page 8

Highlights

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IRC

National or provincial/territorial code — which applies?

The relationship of the provincial/territorial building, fire and plumbing codes, and their national model counterparts is not clear to many.

In Canada, the provinces and territories have sole constitutional authority to regulate the design and construction of buildings, and the maintenance of their fire-protection systems. Most provinces and territories in Canada have legislation that establishes building, fire and plumbing codes that are applied across their jurisdiction.

The question is, then, if this constitutional authority resides with the provinces and territories, why is there a need for documents such as the National Building Code, the National Fire Code and the National Plumbing Code?

There are good reasons, many of which are historic. Up until the 1930s there were no provincial or territorial building codes. The provinces and territories delegated the task to their municipalities. The result was a patchwork of municipal codes across the country that differed from each other and proved to be a significant barrier to getting buildings constructed. In addition to having different requirements, the lack of a science and engineering basis to most of the municipal building codes was of concern to those in the industry. Another problem that arose in the absence of a nationally applicable building code was the difficulty in implementing national programs, such as those to encourage housing construction.

With these concerns in mind, the federal government asked the National Research Council's (NRC) engineers to prepare a model building code based on the best scientific and technological knowledge available. This first model code was published in 1941, just in time to be a major resource in the government's wartime construction activities. This code was used successfully all across Canada.

The new model national building code was so effective that at the end of the war, the government asked NRC to accept the ongoing task of keeping the code up to date.

Provinces/territories that adopt the Model National Codes

Yukon, Northwest Territories and Nunavut	Territory-wide adoption of the National Building Code, National Fire Code and National Plumbing Code (NPC) with some modifications and additions. (Nunavut does not enforce the NPC.)
Saskatchewan and Manitoba	Province-wide adoption of the National Building Code, National Fire Code and National Plumbing Code with some modifications and additions.
Nova Scotia	Province-wide adoption of the National Building Code with some additions and modifications, and the National Plumbing Code. No province-wide fire code. Some municipalities adopt the National Fire Code.

Provinces/territories that publish own codes based on the Model National Codes

Alberta and British Columbia	Province-wide building, fire and plumbing codes substantially the same as national codes, but with variations that are primarily additions.
Quebec	Province-wide building and plumbing codes substantially the same as the National Building Code and National Plumbing Code, but with variations that are primarily additions. Major municipalities adopt the National Fire Code.
Ontario	Province-wide building/plumbing code and fire code based on national codes but with significant variations in content and scope. The Ontario Fire Code, in particular, is significantly different from the National Fire Code.

Provinces that apply some Model National Codes province-wide

New Brunswick	Province-wide adoption of the National Fire Code. Province-wide adoption of the National Plumbing Code with some modifications. Individual municipalities adopt the National Building Code.
Prince Edward Island	Province-wide adoption of the National Plumbing Code. Province-wide fire code not based on the National Fire Code. Major municipalities adopt the National Building Code.
Newfoundland and Labrador	Province-wide adoption of the National Fire Code and aspects of the National Building Code pertaining to fire and life safety that are cross-referenced in the National Fire Code. Municipalities individually adopt the National Building Code. No province-wide building or plumbing code.

The National Building Code continued to develop, overseen by an independent body that became the Canadian Commission on Building and Fire Codes, with the support of IRC (formerly the Division of Building Research). It was later joined by the National Fire Code and later still by the National Plumbing Code.

Beginning in the 1960s, the provinces and territories began to take up their regulatory authority to legislate province- and territory-wide codes. Most adopted the national model codes as their own. Some provinces began to publish their own codes, using the national model codes as the basis, but modifying them or adding to them when deemed necessary. Some provinces only adopt one or two of the three model codes for province-wide (or territory-wide) application, often relying on municipalities to adopt their own codes. The table (see p.2) summarizes the situation today.

The following codes are available from IRC's Client Services at 1-800-672-7990 (U.S. and Ottawa-Hull area, call 1-613-993-2463):

- National Building Code of Canada
- National Fire Code of Canada
- National Plumbing Code of Canada
- Quebec Construction Code – Chapter 1, Building, and National Building Code of Canada 1995 (amended)
- Alberta Building and Fire Codes (in CD format only).

To learn more about the availability of other codes, contact the responsible provincial/territorial government.

Specific questions can be directed to Mr. John Archer at (613) 993-5569, fax (613) 952-4040 or e-mail codes@nrc.ca.

New Revisions and Errata for National Building Code now available

Third Revisions and Errata for the National Building Code of Canada (NBC) 1995 are now available to all users of the NBC. The Revisions and Errata document identifies code revisions approved by the Canadian Commission on Building and Fire Codes, as well as corrections and information updates provided to facilitate the use of the NBC. Revisions are identified by an ***r*** in the margin; errata are identified by an ***e***.

Third Revisions and Errata packages are being mailed to NBC binder and soft cover users who purchased their codes directly from NRC or who returned the reply cards at the front of their books to NRC. CD-ROM users have been sent a notification of the availability of the updates in electronic format. All revisions and errata documents are also available in .pdf format for downloading from IRC's Web site at: http://codes.nrc.ca/codes/home_E.shtml. CD-ROM users should go to the same site and click on CD-ROM and then CD-ROM Errata and Revisions.

If you own the NBC and do not receive your copy of the Third Revisions and Errata, please contact IRC's Publication Sales Department:

Fax: 1-613-952-7673
E-mail: IRC.Client-Services@nrc.ca
Mail: Publication Sales, M-20
Institute for Research in Construction
National Research Council Canada
Ottawa, Canada K1A 0R6

Please provide your name, affiliation and full coordinates, and specify whether you require the document in English or French and whether you have a soft cover, binder (please specify round or angle-D rings), or CD-ROM.

Codes-related Web sites

Canadian Commission on Building and Fire Codes
http://www.ccbfc.org

Canadian Codes Centre
http://codes.nrc.ca

Provincial/Territorial Committee on Building Standards
http://www.ptcbs.org

CCMC evaluates effectiveness of ridge vents

Homeowners and researchers have often wondered about the effectiveness of ridge vents on their roofs. Ridge vents, in combination with eave vents, are intended to provide natural ventilation to the roof space between the insulation and the underside of the roof sheathing of pitched roofs.

The Canadian Construction Materials Centre (CCMC) has recently completed an evaluation of three new ridge vent products made of either three-dimensional polymeric matting or molded plastic. In its evaluation, CCMC determined the effective venting area of each product, and also assessed the product's ability to

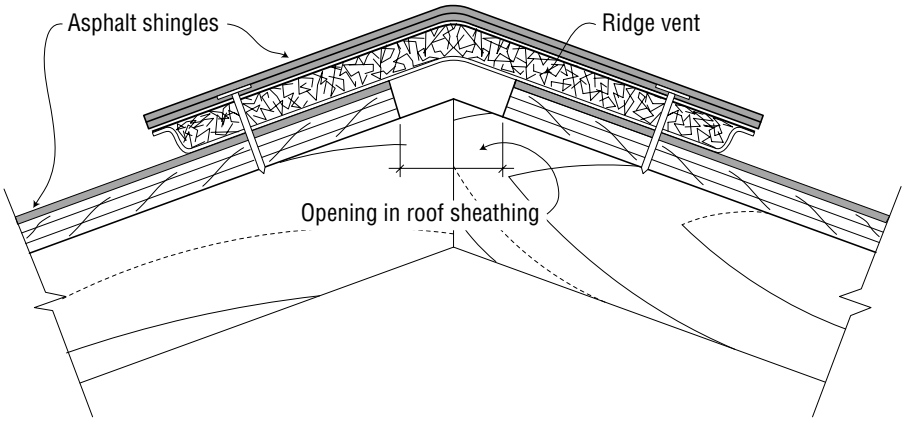
- sustain loads imposed by wind
- prevent rain water entry
- resist traffic loads during installation or roof maintenance.

Evaluation approach

The air flow characteristics of the ridge vent assembly were assessed to determine the effective venting area of the product as installed. This approach was chosen because the vent openings for this type of product are relatively small and their effective size cannot be readily measured using standard measurement techniques. In order to establish equivalency to the roof space venting requirements of the National Building Code 1995 (NBC), Sentence 9.19.1.2.(6), the effective venting area of the ridge vent must be determined.

The effective venting area of each product is established, along with some limitations on usage, in the CCMC evaluation reports. It is based on a specific size of openings in the roof sheathing at the ridge. The reports stipulate that the lateral braces of the trusses must not obstruct these openings. Other limiting conditions stipulated in the reports include:

- Ridge vents must be stopped at least 150 mm from the end of the ridge.
- Ridge vents must be installed in conjunction with eave intake vents that are designed to provide 55% of the total combined unobstructed venting area.
- Sufficient vents must be installed to provide an unobstructed vented area for the roof that is 1/300 of the insulated ceiling area, as required by the NBC. Given the limited venting area provided by the ridge vents, additional roof vents may be required to comply with this requirement.



Each product was installed over an opening created in the sheathing at the ridge of a wood-frame pitched roof assembly. It was then covered with asphalt shingles. The products are all intended for use on pitched roofs with slopes steeper than 1 in 4, and are generally installed over the whole length of the roof ridge.

Evaluation findings

The evaluation demonstrated that the effective venting area varies significantly from one product to another and can be as low as 0.0045 m^2 per linear metre or as high as 0.032 — nearly 10 times as large. In general, the more open the product, the better its venting performance. However, the openness of a product must be weighed against its other physical properties and its durability.

The CCMC Evaluation Reports (Nos. 12523-R, 12961-R and 13000-R) for the three ridge vents can be obtained by contacting CCMC directly or by visiting the Web site at www.nrc.ca/ccmc.

Specific questions can be directed to Mr. Gilles Poirier at (613) 993-6623, fax (613) 952-0268, or e-mail gilles.poirier@nrc.ca.

Foreign initiatives abound — Poland & Italy

The Institute for Research and Construction and Canada Mortgage and Housing Corporation (CMHC) are collaborating to help Canadian manufacturers penetrate the housing markets in Poland and Italy. In 1999 Canada and Poland signed a Memorandum of Understanding (MOU) establishing long-term cooperation in the area of construction. At that time, CMHC called upon IRC's Canadian Construction Materials Centre (CCMC) to help them address the technical issues related to the regulation of housing construction.

CMHC's goal is to negotiate Polish recognition of the Canadian wood-frame construction system and its components that could be used in accordance with Poland's building code. Such recognition would facilitate the export of Canadian products to Poland.

CCMC's role to date has been to provide the technical review of consultants' reports on construction practices designed to meet the intent of the Polish code. Regular annual meetings are held, with the next round of talks scheduled to take place in Canada.

More recently, Italy and Canada signed an MOU regarding the exchange of information on best practices and investment opportunities related to the housing sectors of both countries. Leading up to this MOU, CCMC participated in a tradeshow in Bologna, Italy in Fall 2000 that promoted innovation in housing. The tradeshow featured CMHC's series of Healthy Housing designs, some of which are autonomous and do not rely on municipal services or utilities. The Italians' reaction to Canadian housing technologies was positive and more formal talks stemming from the MOU are anticipated. This continuing dialogue between the two countries is expected to help pave the way for Canadian exports to Italy.

Canadian manufacturers of construction materials who are interested in exporting to Poland or who wish to have more information on these initiatives can contact Mr. Bruno Di Lenardo, CCMC Evaluation Officer, at (613) 993-7769, fax (613) 952-0268, or e-mail bruno.di_lenardo@nrc.ca.

Newsbrief

Scope and evaluation plans prepared for innovative wastewater treatment systems

A recent amendment to the Ontario Building Code Act has transferred authority for regulating small on-lot sewage systems (capacity less than 10,000 litres/day) from the Ministry of the Environment to the Ontario Building Code. The transfer facilitates "one-window" permit issuance.

Since the transfer of authority, CCMC (the only organization designated to perform material evaluations in support of the Minister's rulings on innovative materials, systems and building designs under the Ontario Building Code Act) has received two contracts to prepare scope and evaluation plans for new wastewater treatment systems.

These systems, using on-site modular technologies to treat wastewater from single family residential buildings, work in conjunction with conventional septic tank systems. They are used mainly for rejuvenating failed disposal fields or for cottages where space for a conventional disposal field is at a premium.

CCMC is pleased to extend its technical evaluation service to help manufacturers of new wastewater technologies get their products introduced in Ontario and other provinces and territories throughout Canada.

Specific questions can be directed to Mr. Harry Baker at (613) 993-3807, fax (613) 952-0268, or e-mail harry.baker@nrc.ca.

Feedback from the industry for CITAC

The Canadian Infrastructure Technology Assessment Centre (CITAC), which is an extension of CCMC, is responsible for planning and conducting technical evaluations of new, innovative infrastructure technologies.

Over the past year, CITAC talked with owners and operators of provincial and municipal infrastructure systems and with manufacturers of new infrastructure products and technologies about its assessment service and its role in gaining acceptance and credibility for new innovative products.

From these conversations, CITAC learned that there is a great deal of support for its assessment service among provincial and municipal decision-makers. Alan MacRae, Executive Director, Specialized Support Services, Nova Scotia Department of Transportation and Public Works had this to say:

"I am supportive of the service you offer in providing a technical opinion of new products and technologies for sale by private industry to operators of infrastructure systems. As one of the operators, [our department] will recognize the independent assessments done by CITAC as a useful tool in determining the suitability of the product for our use."

This strong support was echoed by eight of Canada's largest transportation ministries and eight major municipalities in the form of letters sent to CITAC.

Discussions with manufacturers of new products and technologies about CITAC revealed that their awareness of its services and benefits is low: Manufacturers are used to marketing their products by performing successful demonstration projects and having these products assessed by each and every province, territory and municipality across Canada. However, the role of a CITAC assessment in saving them time and money, by eliminating the need for multiple product demonstrations, leading to early market acceptance for their products, is not apparent to most manufacturers.

CITAC is taking steps to make manufacturers more aware of the benefits of its evaluation service, starting with those involved in pavement rehabilitation, trenchless technology and precast concrete. The benefits go beyond reduced time in getting a product to market — for example, working with CITAC at an early stage of product development has the potential to connect manufacturers to NRC's Industrial Research Assistance Program (IRAP), which, through its networks, links companies to needed technologies, business expertise and financial assistance.

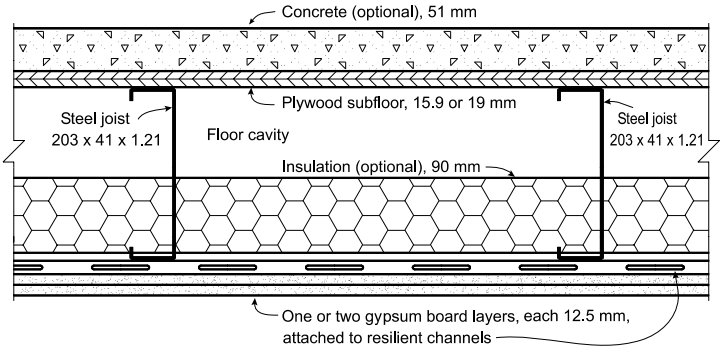
Specific questions can be directed to Mr. Harry Baker at (613) 993-3807, fax (613) 952-0268, or e-mail harry.baker@nrc.ca.

Computational technique provides new tool for estimating fire resistance

IRC fire researchers have recently completed a joint project with the Canadian Steel Construction Council (CSCC) that can provide an alternative to costly fire-resistance testing. The project focused on the numerical modelling of lightweight steel framed (LSF) floor assemblies subjected to fire.

Computational techniques are becoming increasingly important as research tools in the area of structural fire protection because they allow engineers to estimate the fire resistance of various assemblies and produce cost effective designs. This is particularly true in situations where the results of standard fire tests are not available or applicable — for example, when the structure is too large to be tested or when an atypical fire situation must be considered.

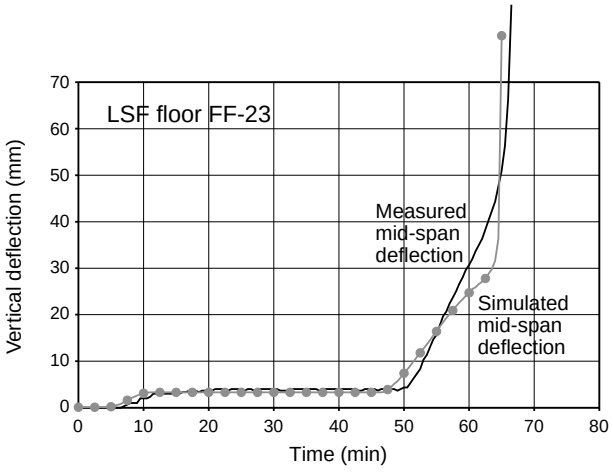
IRC researchers used numerical modelling to trace the complex interaction of thermal and structural phenomena in floor assemblies exposed to fire (top figure). They did this by integrating two different models, the TRACE model and the JOIST model, to create a single model that can predict the fire resistance of a given assembly.



Typical floor assembly used in fire tests

TRACE model

This model, devised by IRC researchers for an earlier study of lightweight steel-frame walls, calculates the heat transfer through the gypsum board into the floor cavity and joists, and subsequently, through the top decking, to simulate the temperature rise in floor assemblies. During the current project (lightweight steel-frame floors), researchers were able to further validate the model predictions using experimental data from full-scale tests with floor assemblies, thus verifying the applicability of the TRACE program to both wall and floor assemblies.



Comparison of predicted and measured deflections

LSF joists after fire test

JOIST model

To simulate the structural behaviour of heated steel joists, the researchers developed a computer program, JOIST, which calculates the deflection in the joist as it is heated, as well as the time of failure. The middle figure shows the model predictions of deflection compared to the experimental results. Through repetitive simulations, the

This work was carried out as part of the Steel Fellowship agreement between the CSCC and IRC. The Fellowship assigns and provides financial support for a researcher, whose work is overseen by an advisory board made up of IRC researchers and industry representatives.

researchers were able to establish failure criteria for cold-formed steel joists at elevated temperatures and to validate the program against experimental data.

Research confirms integrated model

The project confirmed that together the TRACE and JOIST programs provide a comprehensive fire-resistance model for lightweight steel-frame floor assemblies that will be used in future studies and experimental programs, and in the development of design guidelines.

Specific questions can be directed to Mr. Farid Alfawakhiri, Steel Fellow, at (613) 991-2817, fax (613) 954-0483, or e-mail farid.alfawakhiri@nrc.ca.

What we're hearing

Millennium papers from U.S. Transportation Research Board available on the Web

The U.S. Transportation Research Board (TRB), a unit of the U.S. National Research Council, has more than 180 expert committees, covering areas such as pavements, bridges and materials. Late last year (2000) each of the committees published a paper providing a brief overview of their respective fields, with some discussion of the current challenges and the outlook for the future. These papers are available at http://www4.nationalacademies.org/trb/homepage.nsf/web/millennium_papers.

New generation of high-performance insulation systems

There is always a need in the building industry for insulation materials and systems that perform better and cost less than those currently available. New insulation technologies exist — for example, microporous systems, vacuum technologies, and special gas fillings — but, so far, mainly in Europe. Now there is an opportunity for North Americans to get involved in the development and commercialization of one of these new high-performance systems.

The International Energy Agency (IEA) has established a task group to look at various issues surrounding vacuum insulated panels (VIPs) that can provide 10 times the insulating properties of standard materials in use today, for the same thickness. These properties are of great value in situations where space is at a premium, such as in the retrofit of buildings, and in heaters, chimneys, pipe-work, façade elements and wall assemblies.

The International Energy Agency (IEA) is an autonomous agency linked with the Organisation for Economic Co-operation and Development (OECD). Its project, "High Performance Thermal Insulation Systems in Buildings," will be carried out under an Implementing Agreement, "Energy in Buildings and Community Systems, Annex 39."

The task group's main objectives are to

- help improve the performance characteristics of VIPs
- create usable construction systems
- develop international standards to assess the long-term performance of innovative insulation products.

To meet these objectives, the task group will bring together all relevant expertise — researchers, manufacturers, architects and engineers, and building owners. Demonstration projects are also proposed to provide performance data and proof of concept.

Participants from around the world are being sought. Switzerland is leading the project with participation expected from Austria, Denmark, France, Germany, the Netherlands, Italy, Sweden and Canada. IRC has volunteered to lead the Canadian effort and invites those in the insulation industry and those involved in large-scale building projects to join. Participation will provide an opportunity to get in on the ground floor of this initiative, which will address both technical and marketability issues.

If you are interested in learning more about this project and how you can get involved, please contact Dr. Kumar Kumaran, Building Envelope and Structure Program, (613) 993-9611, fax (613) 998-6802, e-mail kumar.kumaran@nrc.ca, or Mr. Harris Cunningham, Marketing, (613) 991-2987, fax (613) 993-3142, e-mail harris.cunningham@nrc.ca.

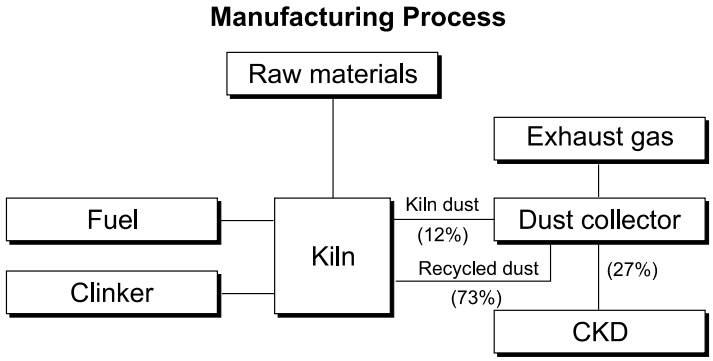
Eco-efficient materials incorporate hazardous wastes

As part of its work on the repair and durability of concrete structures, IRC's Building Envelope and Structure Program is developing eco-efficient materials that promote a clean environment by incorporating hazardous wastes and reducing the emissions of gases such as CO_2. Currently, IRC researchers are focusing on new value-added building materials containing cement kiln dust (CKD), a by-product of the cement manufacturing process.

The manufacture of cement generates an equivalent amount (mass) of CO_2 and produces millions of tons of dust annually. The accumulated industrial waste from this process (CKD) is a source of concern both to the cement industry and environmental agencies, creating an urgent need to find cheap, eco-friendly uses for it.

During the cement manufacturing process, particulates are produced. About three quarters of these particulates are returned to the process, while the remaining one quarter captured in air pollution control equipment are discarded. This discarded material (CKD) contains extremely alkaline materials, such as sodium and potassium, and may also include heavy metals, such as lead and cadmium, making it difficult to dispose of — it can't be reused in the cement manufacturing process or stored or dumped. And because CKD is unstable (heavy metals are encapsulated but not fixed in CKD's molecular structure), it can't be easily handled or treated.

CKD has some positive attributes, however. It is similar to ordinary Portland cement, both in terms of its chemical composition and physical properties. This similarity may be the key to its successful reuse in durable and eco-efficient products, such as blended cements containing CKD along with suitable additives to immobilize alkali and heavy metals.



Cement manufacturing process

IRC researchers have already produced cement containing significant amounts of CKD that demonstrates excellent strength characteristics. But before considering its possible uses, the level, mobility and leachability of the trace metals in the CKD have to be assessed. The current research is taking another approach, which focuses on the development of new structures to encapsulate and chemically bind the trace elements. With this approach, concerns about the leaching of heavy metals can be eliminated.

IRC is currently negotiating a partnership with a multi-national cement manufacturer to further develop technologies for reusing CKD.

Specific questions can be directed to Dr. Laila Raki at (613) 993-4028, fax (613) 954-5984, or e-mail laila.raki@nrc.ca.

Unique new "weather machine" studies wall performance

Continued from cover page

- a complete data acquisition package to control and monitor experiments, and a comprehensive data analysis technique for interpreting the results.

The next stage of development for this facility will integrate the effects of rain, wind and some aspects of solar radiation.

Specific questions can be directed to Dr. Wahid Maref at (613) 993-5709, fax (613) 998-6802, or e-mail wahid.maref@nrc.ca.

IRC researchers and their industry partners are using the Envelope Environmental Exposure Facility in the MEWS Project (Moisture Management for Exterior Wall Systems). The project objective is to develop effective moisture control strategies for walls in various climates.

The project partners are:
Canada Mortgage and Housing Corporation ◆ members of Canadian Fiberboard Manufacturers Association ◆ Canadian Plastics Industry Association ◆ Canadian Wood Council ◆ Dupont ◆ EIMA (External Insulation Manufacturers Association) ◆ Forintek Canada Corporation ◆ Fortifiber Corporation ◆ Louisiana-Pacific Corporation ◆ Marriott International ◆ Masonry Canada

New consortium project to develop performance guidelines for crack sealants

More than two thirds of Canada's road network is under the jurisdiction of municipalities, with ninety percent in need of immediate repair. The cost of repair work is estimated at $8.5 billion.

Since preventive maintenance is the best way to delay road deterioration, extend service life and maximize shrinking public funds, crack sealing programs can provide an optimal approach, with the potential to increase pavement service life by 10-20% and with savings of more than $800 million.

While crack sealing is one of the most common and easiest means of preventive maintenance, it is not being used as effectively as it should be. Sealant failure within three years of application is common, with failures often occurring in the first year. These premature failures stem mainly from inappropriate sealant selection and installation, a direct result of inadequate performance guidelines.

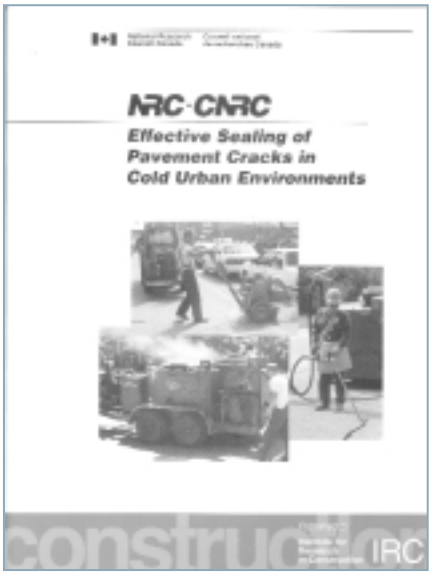
Sealant installation and selection

IRC has already tackled the problem of sealant installation in its publication *Effective Sealing of Pavement Cracks in Cold Urban Environments*, which reviews the fundamentals of sealant performance, highlights common installation problems, and describes effective installation. This best-seller is now being used throughout Canada, but the issue of sealant selection needs to be addressed.

The guidelines will allow users to select sealants based on specific local needs … and will lead to decreased roadway maintenance costs, easier management of crack sealant programs and extended pavement service life.

IRC, in partnership with the Virginia Tech Transportation Institute, is in the process of building a consortium with North American partners to study the issue of sealant selection. The proposed multi-year project will include the development of

- procedures to measure the short- and long-term aging affects of bituminous sealants
- a method to assess sealant performance
- a sealant adhesion test that takes aggregate type into account
- performance guidelines for sealant selection.



Project benefits

The guidelines will allow users to select sealants based on specific local needs (e.g., climate conditions) and will lead to decreased roadway maintenance costs, easier management of crack sealant programs and extended pavement service life.

The project will also offer benefits to sealant producers that include improved quality control and better matching of products to specific climate conditions. These improvements in turn will lead to savings (because there will be less product rejection) and increased use of crack sealing, which will translate into a greater demand for materials.

Workers apply crack sealant to pavement

Invitation to join the project

IRC is seeking those with experience and knowledge of crack sealing and sealants — municipalities, provincial or state departments of transportation, airport authorities and material producers — to participate in this project.

For more information, contact Dr. J-F. Masson at (613) 993-2144, fax (613) 952-8102, or e-mail jean-francois.masson@nrc.ca.

Construction Technology Updates: practical information for the construction professional.

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OR
Call our toll-free number, 1-800-672-7990 (U.S. and Ottawa-Hull area, call 1-613-993-2463).

1997 Collection

No. 1 Control of Sound Transmission through Gypsum Board Walls
No. 2 Fire Resistance of Gypsum Board Wall Assemblies
No. 3 Maintaining Acceptable Air Quality in Office Buildings through Ventilation
No. 4 Ways to Reduce Blistering in Built-up Roofs
No. 5 Window Condensation in Historic Buildings that Have Been Adapted for New Uses
No. 6 Fire Resistance of Concrete-Filled Steel Columns
No. 7 Corrosion of Metal Ties in Masonry Cladding
No. 8 Six Axioms for Building Durable Concrete Structures
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1998 Collection

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No. 15 Current Approaches for Mechanical Ventilation of Houses
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No. 17 Pressure Equalization in Rainscreen Wall Systems
No. 18 Obtaining Effective Half-Cell Potential Measurements in Reinforced Concrete Structures
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AUGUST

16-19
2001 Second International Conference on Engineering Materials. San Jose, CA. http://conc.civil.okayama-u.ac.jp/~jsce/jsce315/

19-20
Canadian Regulatory Committee on Plumbing. Victoria. Contact: Raman Chauhan at (613) 993-9633, e-mail raman.chauhan@nrc.ca

20-22
Sixth International Symposium on Creep, Shrinkage and Durability Mechanics of Concrete and Other Quasi-Brittle Materials (CONCREEP 6). Cambridge, MA. http://cist.mit.edu/concreep-6

27-28
Executive Committee, Canadian Commission on Building and Fire Codes. Toronto. Contact: John Archer at (613) 993-5569, e-mail john.archer@nrc.ca

27-31
XV International Conference on Soil Mechanics and Geotechnical Engineering. Istanbul, Turkey. http://www.ins.itu.edu.tr/2001/

SEPTEMBER

9-12
American Public Works Association, APWA 2001. Philadelphia. www.apwa.net

16-19
2001 Annual Conference and Exhibition of the Transportation Association of Canada, "Preparing for Success in Transportation." Halifax. www.tac-atc.ca

17-18
Joint CCBFC/PTCBS Task Group on Implementation of the New Code Development System. Location to be determined. Contact: Richard Desserud at (613) 993-9960, e-mail richard.desserud@nrc.ca

OCTOBER

1-2
Provincial/Territorial Policy Advisory Committee on Codes. Edmonton. Contact: John Archer at (613) 993-5569, e-mail john.archer@nrc.ca

3-10
Annual Conference of the Association for Preservation Technology. Monterey Peninsula, CA. http://www.apti.org/

10-13
Civil Engineering Conference and Exposition 2001. Houston. http://www.asce.org/conferences/annual01/

11
Expo-Contech. Montreal. www.contech.gc.ca

22-24
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28-29
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