Volume 6 Number 1 **Winter 2001**

construction innovation

NRC · CNRC

IRC develops new software for designing buildings to minimize aircraft noise

IRC has almost completed a three-year project that will give architects and builders a new and better design tool for insulating buildings against noise from aircraft.

The need for the Insulating Buildings Against Noise from Aircraft (IBANA) project stemmed from the fact that existing information had become virtually obsolete because of changes in Canadian construction practice — for example, thicker walls with more thermal insulation, which could improve sound insulation, and increased venting of attic spaces, which could reduce it. As well, aircraft have changed — newer commercial jet aircraft are quieter than their predecessors but have different noise characteristics.

Aircraft tend to be much louder when moving away from a building than when approaching it.

There are three major components to the project: The first consisted of laboratory tests of the sound insulating properties of building facade elements, including various wall and roof constructions. In performing these tests, the frequency range of measurements was extended to include the important lower frequencies — aircraft noise levels can be quite strong, but measurements at these lower frequencies had not previously been carried out. The results are included in a report, which can be obtained from IRC.

The second component of the project involved field measurements of the sound insulation of various constructions exposed to real aircraft noise. Systematic variations,

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Highlights

Infrastructure Guide will go ahead

An agreement involving Infrastructure Canada, the Federation of Canadian Municipalities (FCM) and the National Research Council will see funding of up to $12.5 million from the federal government to develop the National Guide to Sustainable Municipal Infrastructure: Innovations and Best Practices. Municipal governments and the private sector have played key roles in the project's conception and are expected to invest $12.5 million through in-kind contributions towards the Guide's development.

The Guide will comprise a compendium of technical best practices for decision-making and investment planning as well as for the construction, maintenance and repair of municipal infrastructure systems. NRC and the FCM will ensure that it

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Published by

Institute for Research in Construction IRC

Frequently asked questions about objective-based codes

The Canadian Commission on Building and Fire Codes, in partnership with provinces and territories, has recently undertaken a public consultation on the proposed objectives, structure and cycle of the new objective-based national model building, fire and plumbing codes. Background information to these codes and the consultation may be found at the CCBFC Web site http://www.ccbfc.org.

The following are some of the frequently asked questions encountered during the consultation.

1. **Will objective-based codes increase the risk of liability for municipalities and municipal officials?**
   In any given situation, the liability associated with code compliance will be the same under objective-based codes as it is now. Liability results from responsibility. The building code establishes the characteristics of the finished building; it does not identify who is responsible for making it that way. This is established in several other ways such as provincial and territorial legislation, contractual arrangements and normal civil liability laws. The new objective-based version of the code will not change this. The additional information provided in the new codes may actually reduce risk.

2. **Will objective-based codes force local authorities to accept alternative approaches that don't nominally comply with the codes?**
   Objective-based codes may increase the frequency with which alternative solutions are encountered by local authorities, as the new codes will clarify how they can be evaluated. However, experience in other countries indicates that there is not likely to be a dramatic increase. Local authorities already have to evaluate alternative solutions under the "equivalents" provisions of the codes (e.g., Section 2.5. of the National Building Code). The additional information on the purpose and intent of the code requirements provided by objective-based codes gives the municipal official a clearer picture of what must be assessed and the proponent a better understanding of what an alternative solution must achieve to comply with the intent of the code.

3. **Will training programs be put in place to ease the introduction of objective-based codes?**
   The training needs created by objective-based codes are expected to be modest — the technical requirements are substantially the same. However, their introduction has created an opportunity to stimulate a more national approach to providing training for code users. Accordingly, a national steering committee on training for objective-based codes has been formed. This committee will evaluate training needs for engineers, architects, technologists, contractors, as well as building and fire officials. It will also work to develop the necessary "bridging" training and education materials, and collaborate in their delivery.

4. **Won't it be annoying (confusing) having to flip back and forth between two documents (Division A and Division B)?**
   The two divisions will be published in one document. Division A addresses the objectives and functional requirements of the codes. Most users won't consult Division A. They will just use the acceptable solutions set out in Division B, which are primarily the provisions of the current codes. Users are likely to consult Division A only when designing or evaluating an alternative solution or when wishing to better understand the reasons for specific requirements in the codes.

5. **Won't the objective-based codes be voluminous?**
   They will be larger, but not by much. The new Division A is not expected to add more than 25 or 30 new pages to the documents. Division B will be only slightly longer than the text of the current provisions in the codes as a result of its references to the Division A objectives and functional requirements. Additional acceptable solutions will find their way into the codes over time, possibly increasing their size, just as new technical requirements can do in the present codes.

For previous *Construction Innovation* articles about the move to objective-based codes see
Volume 3 Number 1, Fall 1997
Volume 3 Number 4, Summer 1998
Volume 4 Number 1, Fall 1998
Volume 4 Number 4, Fall 1999

ANNOUNCING NEW QUEBEC CONSTRUCTION CODE INTEGRATED WITH THE NATIONAL BUILDING CODE

The **National Research Council of Canada**'s (NRC) Institute for Research in Construction and the **Régie du bâtiment du Québec** (RBQ) are pleased to announce the publication of the *Quebec Construction Code – Chapter I, Building, and National Building Code of Canada 1995* (*amended*) (see ***Construction Innovation***, Volume 5, Number 3, Summer 2000 for details).

This new document, published by NRC in collaboration with the RBQ, includes the requirements of Chapter I, Building, of the Quebec Construction Code as well as an amended NBC that clearly indicates to readers the changes adopted by Quebec to suit its specific needs. The amended NBC includes the first three series of revisions and errata, approved by the Canadian Commission on Building and Fire Codes. This offers users the advantage of not having to annotate their NBC by hand or to refer to several documents to find the requirements that apply to the construction or renovation of buildings in Quebec.

The Quebec Construction Code with the amended NBC is available in print (in both full-size binder and soft-cover format). It will be offered this fall on CD-ROM.

Don't delay! Order now!

To order this new document, simply fill out the order form in the centre of this newsletter or call IRC, toll free, at 1 800 672-7990.

New *Canadian Highway Bridge Design Code*

The Canadian Society for Civil Engineering (CSCE), in collaboration with Randerson Consulting, is offering a national series of seminars on CSA's new ***Canadian Highway Bridge Design Code***. The series is also sponsored by CSA International.

Dates & Locations

Toronto, ON – April 23-25	2 or 3 days
Ottawa, ON – April 26-27	2 days
Edmonton, AB – May 7-9	3 days
Winnipeg, MB – May 10-11	2 days
Moncton, NB – May 24-25	2 days
Victoria, BC – May 29-30	2 days

For more information, please contact Mahmoud Lardjane at (514) 933-2634, ext. 26; e-mail: mahmoud@csce.ca, or visit CSCE's Web site at: www.csce.ca.

Codes upcoming events

May 12
National Steering Committee on Training and Education for Objective-Based Codes. Ottawa. Contact: John Archer at (613) 993-5569; john.archer@nrc.ca

June 10-12
Standing Committee on Building and Plumbing Services. Saint John. Contact: Raman Chauhan at (613) 993-9633; raman.chauhan@nrc.ca

June 14-16
Standing Committee on Houses. Fredericton. Contact: Michel Lacroix at (613) 993-0056; michel.lacroix@nrc.ca

June 14-16
Standing Committee on Hazardous Materials and Activities. Halifax. Contact: Philip Rizcallah at (613) 993-4064; philip.rizcallah@nrc.ca

June 21
Standing Committee on Environmental Separation. Ottawa. Contact: Adaire Chown at (613) 993-0352; adaire.chown@nrc.ca

CCMC evaluates an integrated life safety (ILS) inverter system

An integrated life safety (ILS) inverter system serves as an emergency power supply to maintain the emergency lighting and fire-alarm systems required by the National Building Code of Canada (NBC) when the primary power source fails. While the intent of the code is clear, (see box for specific NBC requirements), there are no Canadian codes or standards that can be used to determine whether an ILS system meets the code requirements for a separate emergency power supply.

The distributor of the "Edwards Dual-Lite ILS AC Inverter System" sought confirmation from CCMC that its system met the intent of the code. In response, CCMC developed the Technical Guide for AC Inverter Systems for Emergency Power Supply, which provides criteria and requirements for ascertaining this.

The test results and assessments provided by the manufacturer show that the product complies with CCMC's Technical Guide and, if used according to the limitations and conditions stated in the evaluation report, provides a level of service equivalent to that required by the NBC (see box). Although ILS systems are not dedicated solely to emergency use (they also serve as a power source for security night lighting, cash registers, and building management and communications systems), the scope of the evaluation was limited to determining whether the ILS system provided a level of performance equivalent to that required for a separate emergency power supply as specified in the NBC. The application of the evaluation is limited to buildings that require a separate emergency power supply. It does not include hospitals or nursing homes.

Specific NBC requirements

Section 3.2.7.4 Emergency Power for Lighting
Section 3.2.7.8 Emergency Power for Fire Alarm Systems and 9.9.11.3 Emergency Lighting

The report also stipulates the following conditions and limitations on usage:

- Procedures for operating, inspecting and testing as identified in the operating and maintenance manual must be followed;
- In sprinklered buildings, the service room where the system is installed must be sprinklered and the enclosures housing the system must be sprinkler proof;
- The system must be located in a ventilated room under specific temperature and humidity conditions;
- The system must be capable of powering any combination of lighting types (electronic ballast, power factor corrected ballast, and self-ballasted fluorescent, incandescent or HID lighting).

For more information about this evaluation, see CCMC Evaluation Report 12965-R, which is available upon request or can be viewed on the CCMC Web site www.nrc.ca/ccmc.

There are three other similar products currently being evaluated. The reports for these systems are expected to be available this spring.

Specific questions can be directed to Mr. Luc Cécire at (613) 993-0776, fax (613) 952-0268, or e-mail luc.cecire@nrc.ca.

Notice

It has come to our attention that Pine Roof Canada Inc. continues to use, in association with its pine shake products, CCMC evaluation report No. 11866-R (Majestic Pine Shake), despite the fact that this evaluation lapsed on 27 February 1997 and has not, since that date, been considered as valid. Despite several requests to do so, CCMC has been unable to persuade the company to discontinue its unauthorized use of the above report. Please take note that the evaluation in the above report has, as mentioned, lapsed and should no longer be relied upon in connection with the above, or any other, company's products.

Readers are reminded to check CCMC's Registry of Product Evaluations to confirm the compliance of a particular product (Web site: www.nrc.ca/ccmc).

World technical assessments will benefit exporters of innovative construction products

The World Federation of Technical Assessment Organizations (WFTAO) has agreed in principle to a process for developing a World Technical Assessment (WTA), which would greatly benefit manufacturers and exporters of innovative construction products.

The approach, expected to be finalized at the WFTAO's meeting in October 2001, would allow new products to gain simultaneous assessments in two or more countries. With this approach, a proponent of an innovative product would make an application for evaluation by a member organization such as IRC's Canadian Construction Materials Centre (CCMC). Common assessment requirements would be established to avoid duplicate testing — variations required to satisfy country-specific needs would be addressed separately. Ultimately, each participating organization would publish a formal report that documents a product's performance, with a WFTAO cover page.

The federation also agreed to the following:

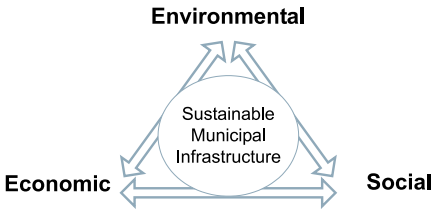
- a new Web site (www.wftao.com) designed to promote the WFTAO to proponents and users of innovative products;
- a task group to consider the expansion of the WTFAO's scope to include environmental assessments; and,
- an investigation into the need for accredited internal quality control programs for members.

The federation now comprises 25 organizations from 21 countries, including assessment agencies within the three major trading areas: the Americas, Europe, and the Pacific Rim. Canada is represented by CCMC.

Specific questions can be directed to Mr. John Berndt at (613) 993-5353, fax (613) 952-0268, or e-mail john.berndt@nrc.ca.

Infrastructure Guide will go ahead

Continued from cover page



is made available to municipalities of all sizes across the country, providing them with valuable information about better and more innovative design and construction techniques.

"A National Guide to Sustainable Municipal Infrastructure represents another important step towards realizing our fundamental objective: using new technologies and best practices to provide 21st Century infrastructure to improve the life of all Canadians," said Lucienne Robillard, Minister responsible for infrastructure. She added, "The Government of Canada projects that the adoption of best practices and innovations will lead to anywhere from $800 million to $1.5 billion in savings on annual infrastructure maintenance costs for municipalities nation-wide. Long-term savings of this magnitude would represent a substantial return on investment for this initiative."

In accordance with Infrastructure Canada's dedication to the enhancement of "green" infrastructure, the Guide will initially emphasize best practices and innovations related to drinking water, storm water and waste water systems.

For more information, please visit the Guide's Web site at www.infraguide.gc.ca or send us an e-mail at infraguide@nrc.ca.

Water-mist fire extinguisher offers excellent protection for wide range of applications

Fire researchers at IRC have continued to extend the application of their water-mist fire-suppression technology, developed for the protection of machinery spaces and commercial cooking areas (see *Construction Innovation* Winter 1998, Vol. 3, No. 2 and Spring/Summer 1999, Vol. 4, No. 3). In collaboration with Fountain Fire Protection Inc. (FFP), they recently developed a prototype portable water-mist fire extinguisher that is suitable not only for commercial cooking areas but also for office buildings, houses, industrial 'clean rooms,' machinery spaces, medical centres and telecommunication facilities.

Fires can be classified into five different types — those involving organic materials, such as wood and paper (Class A), flammable liquids (Class B), electrical equipment (Class C), combustible metals (Class D) and cooking oils (Class K). Different types of fires must be tackled in different ways, and a technique that works for one type does not always provide proper protection for another. As well, some currently available extinguishers create clean-up and environmental problems, and are expensive. They may also generate toxic or corrosive combustion by-products during fire suppression, causing danger to people and damage to facilities, and thus are not suitable for protecting medical centres, telecommunication facilities, industrial 'clean rooms' or food processing plants.

A water-mist fire extinguisher is tested in a restaurant kitchen mock-up.

In the project, IRC researchers identified the optimum parameters of the extinguisher required for putting out different classes of fires, including water-mist and nozzle characteristics, and discharge pressures.

Compared to conventional extinguishers, the water-mist extinguisher is inexpensive and efficient in suppressing various types of fires and, at the same time, its use requires less clean-up, and does not result in environmental problems.

The test results showed that the portable water-mist extinguisher developed in this project is suitable for use on fires associated with cooking oil, wood and paper, flammable liquids and electrical equipment. The extinguishing times and the quantity of water required to extinguish the fires varied depending on the type of fuel used in the fire. No splashing or spillage of the oil/fuel was observed during fire suppression, and no arcing occurred when water mist was discharged towards an electrically energized target.

Compared to conventional extinguishers, the water-mist extinguisher is inexpensive and efficient in suppressing various types of fires and, at the same time, its use requires less clean-up, and does not result in environmental problems. It is a cost-effective means of fire suppression, and able to provide protection for a wide range of applications. Its main drawback is that in order to extinguish fires, the operator must stand relatively close to the fire — momentary flare-ups may occur while suppressing some types of flammable liquid fires. Further research will seek to overcome this drawback.

Specific questions can be directed to Dr. Zhigang Liu at (613) 990-5075, fax (613) 954-0483, or e-mail zhigang.liu@nrc.ca.

Fire researchers investigate safe use of halon replacement handheld extinguishers

Handheld fire extinguishers containing halocarbon streaming agents (such as FE-36, Halotron I, FM-200 and CF_3I) that can replace ozone-depleting halon are now commercially available. However, there are concerns about how people will be affected when exposed to the halon replacements and their toxic by-products during fires.

IRC's Fire Risk Management Program, in partnership with the Department of National Defence, has just completed a series of experimental studies to assess this exposure risk. Four different halocarbon extinguishers were used to extinguish liquid fuel fires of different intensities in small compartments (45 m^3 and 120 m^3) and in a large burn hall (21,000 m^3).

Measurements showed that for all test scenarios, the concentrations of the streaming agents were below the levels that would pose a life or health risk to either the operator or other personnel according to toxicity restrictions established by the U.S. Environmental Protection Agency.

Operator puts out fire with handheld extinguisher containing a halocarbon streaming agent.

The IRC researchers measured gas samples from the fire, the operator breathing zone and the surrounding area to determine the exposure risk in each. Measurements showed that for all test scenarios, the concentrations of the streaming agents were below the levels that would pose a life or health risk to either the operator or other personnel according to toxicity restrictions established by the U.S. Environmental Protection Agency.

However, in the small compartments, there were dangerous levels of acid gas by-products generated during fire suppression. Hydrogen fluoride (HF), which can cause sensory and pulmonary irritation, depending on its concentration, exposure duration and the health of individuals, was one of the major by-products. One of the extinguishers also produced hydrogen chloride (HCl). The highest concentrations of HF and HCl were found in the smallest compartment with large fires. The concentrations of HF in the operator-breathing zone generated by the four halocarbon agents presented a severe life hazard if inhaled.

In the surrounding corridor, the HF and/or HCl concentrations were well below dangerous levels in most cases and the conditions were tenable for evacuation purposes. Closing the door after the fire was extinguished prevented excess heat and toxic gases from moving to the surrounding area.

Exposure to heat from the fire was another safety concern. When the operator started to extinguish the liquid fuel fire, there was a momentary flare-up, the size of which was proportional to the initial size of the fire. The peak heat produced during the flare-up exceeded the tenability limit in all the tests and presented a severe hazard to the operator. This hazard was more severe in small, confined spaces than in large open or enclosed spaces.

The research indicates that, in small confined spaces, the operator must have self-contained breathing apparatus and wear heat-protective clothing before engaging in fighting this type of fire with a handheld halocarbon extinguisher. Also, in real-life applications, it would be important to take measures to prevent potential corrosion to sensitive equipment since acid gases are a by-product of halocarbons.

Specific questions can be directed to Dr. Joseph Su at (613) 993-9616, fax (613) 954-0483, or e-mail joseph.su@nrc.ca.

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IRC evaluates corrosion in repaired concrete bridge slabs

A recently completed research project to evaluate the corrosion of the steel reinforcement in repaired concrete from the old Perley Bridge in Hawkesbury, Ontario has shown that corrosion can be predicted more reliably when the results from various corrosion monitoring techniques are considered and analyzed. This work on the Perley Bridge was partially supported by Public Works and Government Services Canada.

Old Perley Bridge

Slab from old Perley Bridge with top reinforcement exposed

The old two-lane bridge, which has now been replaced by a new four-lane bridge, had a reinforced concrete deck supported by a steel structure. Over the past decades, the deck had undergone extensive repair as a result of corrosion-related deterioration. Because the age and exposure conditions of the bridge are known, the examination of the slabs will provide valuable information about deterioration mechanisms and their effects on the corrosion of reinforcing steel.

Many reinforced bridges throughout North America show signs of serious deterioration, mainly caused by the breakdown of the protective film on the surface of the reinforcing steel formed when the steel comes in contact with the highly alkaline cement matrix.

The probability and rate of corrosion are affected by many factors, most notably atmospheric carbon dioxide, sulphur dioxide, nitrous oxide, and chloride from the ocean or de-icing salts. The availability of oxygen at the interface of the steel reinforcement and the concrete is also an important factor.

Since the early 1980s, half-cell potential measurements have been used to identify reinforcing steel (rebar) corrosion in concrete or to assess the condition of existing concrete structures. Although this method provides an indication of the likelihood of corrosion activity through measurement of the potential difference between a standard portable half-cell and the reinforcing steel, it does not help determine corrosion rates or the degree of corrosion that has already occurred. When interpreting half-cell potential data, many factors, such as chloride and oxygen concentration, temperature and moisture content, must also be considered.

The guidelines described in ASTM C876, *Standard Test Method for Half-Cell Potentials of Reinforcement in Concrete*, provide general principles for evaluating the probability of corrosion of reinforcing steel in concrete. However, in many cases, the corrosion conditions predicted by the guidelines are quite different from the actual conditions to which the reinforcing steel is subjected. As well, a large discrepancy between the condition assessment and the actual deterioration has been observed in many bridges when they are about to undergo repair. In some cases, areas rated according to the ASTM standard as corrosion-active were found to be in good condition once the concrete cover was removed, indicating that while the half-cell method provides important information, the results must be verified by other measures.

In the Perley Bridge research project, several corrosion monitoring techniques, including half-cell potential, linear polarization and concrete resistivity measurements, were used to evaluate the state of the steel reinforcement in the repaired concrete from four slabs removed from the bridge. As part of the investigation a number of cores were taken from the slabs in order to provide data on existing concrete.

The investigation clearly showed that each type of corrosion measurement has specific characteristics and limitations and that, in combination, the measurement techniques can provide a good indication of active corrosion in the reinforcement. IRC's Urban Infrastructure Program is planning further investigations into the reliability of various techniques, which will take environmental conditions into account.

Specific questions can be directed to Dr. Shiyuan Qian at (613) 993-3814, fax (613) 952-8102, or e-mail shiyuan.qian@nrc.ca.

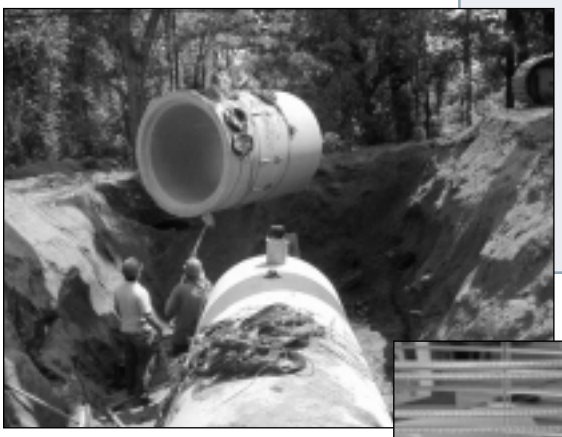
Researchers monitor concrete pipe installation to validate design approach

Industry, and government — both provincial and municipal — are collaborating with IRC in a research project that could have a major impact on the pipe construction industry in Canada. The research objective is to verify a new approach to specifying drainage pipes and embedment (the material surrounding the pipe) that could result in more options for specifiers, better pipe performance and increased cost effectiveness.

Current specifications for the design and installation of drainage pipes in Ontario provided in various Ontario Provincial Standard Specifications (OPSS) and Drawings (OPSD) represent best practice and have been widely and successfully used in Ontario. However, like most other specifications for buried pipes, the OPSS are based on the traditional Marston-Spangler theory and do not include the recent development of the Standard Installations Direct Design (SIDD) approach.

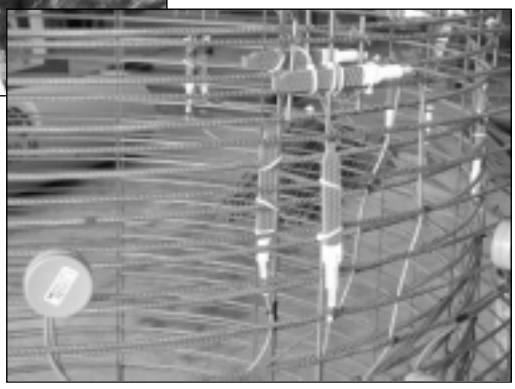
In the Marston-Spangler approach, the design of the pipe is based on the crushing strength required to withstand soil and traffic loads. This approach uses a bedding factor, which depends on soil type and density as well as the nature of the pipe/soil contact, to relate the strength of the pipe tested in the laboratory to the strength required in the field. In the SIDD method, the design of the pipe wall — its thickness and amount of reinforcement — is based on the stresses and strains in the pipe. The latter approach is more precise and can result in pipes that require less material. In addition, the SIDD approach permits greater choice of backfill materials — from granular materials to clay — and needs less compaction of the backfill.

Earth pressure cells on the pipe surface and in the backfill soil measure the pressure distribution around the pipe.



The partners in this project are

- Ontario Concrete Pipe Association
- Ontario Ministry of Transportation
- City of Ottawa
- Institute for Research in Construction



Embedded strain gauges for measuring strains in the pipe wall

The project will verify the performance of concrete pipe installed using the SIDD method in typical climatic conditions encountered in Ontario, and provide recommendations for updating the relevant OPSS.

In the summer of 2000, two different types of SIDD installations (Type 2 and Type 3) were included in the construction of a 1370-mm (54 in.) diameter precast concrete culvert as part of the overall project. Two of the pipe sections were cast with embedded strain gauges for measuring strains in the pipe wall (see photo on right). These instrumented pipes were placed on either side of the road centreline, separated by a non-instrumented pipe section. The same granular material was used for bedding and backfill up to the springline (mid-height of the pipe) for the entire culvert; however, the degree of compaction varied according to the respective specification. The trench above the springline was backfilled with the excavated native soil.

Earth pressure cells were installed on the pipe surface and in the backfill soil to measure the pressure distribution around the pipe (see photo on left). Soil temperatures are measured with thermocouples at the pipe centreline and at the edge of the trench. On the road surface, rows of survey pins facilitate periodic surveys (four times a year) of road settlements. All the installed sensors are connected to and controlled by on-site dataloggers with the data transferred to the IRC laboratory by a modem link.

The results of this in-situ performance monitoring, which will continue for three years, will provide a better understanding of pipe behavior and pipe/soil interaction.

Specific questions can be directed to Ms. Lyne Daigle at (613) 998-2584, fax (613) 954-5984, or e-mail lyne.daigle@nrc.ca.

U.S. 20-year plan will lead to healthier, more energy-efficient commercial buildings

The U.S. Department of Energy (DOE) and its partners in both the public and private sectors have released a 20-year plan to make the next generation of commercial buildings more energy efficient and healthy.

The DOE's goal is to reduce energy use of new commercial buildings by 20 percent by the year 2010, and by 50 percent by 2020. Details of the plan are outlined in High-Performance Commercial Buildings: A Technology Roadmap. This defines the industry's long-term vision and strategies, and examines the challenges ahead.

"This effort will focus on improving the quality, comfort, utility and cost effectiveness of new commercial buildings," says a DOE news report. "Thirty-two percent of the electricity generated in the United States goes to heat, cool, ventilate and light commercial buildings at an annual cost of $77.6 billion. We will all benefit from commercial buildings that are more energy efficient and healthier places to work."

Developing a roadmap is an essential part of the process of achieving improved building performance because it aligns the work of government departments and agencies to avoid duplication, ensures that research is also in step with government policies, and promotes technology exchange between government research organizations and private industry. A roadmap pulls together different areas of building research in recognition of the fact that an efficient building must be a complete system, not just a collection of individual components.

Success will be achieved by combining the results of research in such fields as energy-efficient building envelopes, lighting and daylighting, passive and active energy sources, indoor air quality, and advanced sensors and controls.

The Institute for Research in Construction (IRC) is involved in a similar Canadian-based program through Natural Resources Canada's (NRCan) Panel of Energy Research and Development (PERD) Program. As well, IRC, together with NRCan, is leading a technical exchange between research laboratories in the U.S. and Canada. This is part of a memo of understanding (MOU) between NRCan and DOE. The establishment of this gateway will help ensure that researchers are kept abreast of technological developments across the spectrum of research fields, continent wide.

For further information about the DOE Technology Roadmap, visit the Web site at http://www.eren.doe.gov/buildings/commercial_roadmap.

Roadmap will point way for future intelligent buildings technologies

Work is well underway on a technology roadmap that will point the way to the short- and mid-term future for the North American intelligent buildings sector. A technology roadmap is an outlook, or guide, for the industry that identifies emerging technologies and market niches as well as the barriers to such developments, helping stakeholders to make investment and policy decisions.

Backed by funding from five Canadian government departments and agencies, and guided by a steering committee drawn from both the public and private sectors, the Technology Roadmap for Intelligent Building Technologies project will help pinpoint potential markets, technology gaps and research requirements.

The roadmap project began in September 2000 and will be completed this spring. Its focus is on the short term, with a five-year horizon, since intelligent building technologies are evolving so rapidly.

This project concentrates on technologies related to high-rise residential and commercial, industrial and institutional buildings, and covers the spectrum from main equipment to sensors and communications, artificial reasoning and automated controls. Application areas include energy management, office automation, indoor environment, local area networking, security, fire control, and maintenance scheduling, with practical considerations dictating the specific selection.

While many of these sub-systems have previously operated independently, there is now a trend towards integration. Among other things, the project will identify the barriers faced by all stakeholders in the sector, including builders and developers, owners, operators, managers, engineers and architects, tenants and consumers. It will also provide a valuable tool for those companies designing and manufacturing products for intelligent buildings, better enabling them to meld development efforts with marketing.

The five government departments and agencies funding the project are Industry Canada, Public Works and Government Services Canada (PWGSC), Natural Resources

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IRC develops new software for designing buildings to minimize aircraft noise

Continued from cover page

such as the number of layers of gypsum board or the size of windows, were made to a test house constructed at the Ottawa airport. Measurements were also made on various existing buildings near the Toronto and Vancouver airports.

The results from the Ottawa airport test house are being used to gain a better understanding of the factors that are responsible for the difference in the sound insulation ratings obtained in the laboratory and those from actual buildings exposed to real aircraft noise.

In the laboratory, the sound insulation of walls or roofs is measured in ideal test conditions in which sound strikes the test specimen more or less equally from all directions. In real buildings, aircraft noise strikes the building facade from a small range of angles, which depend on the orientation of the facade relative to the flight path. The matter is further complicated by the fact that aircraft do not radiate sound equally in all directions and tend to be much louder when moving away from a building than when approaching it.

The third component of the project is the development of Windows-based software that will be more accurate and easier to use than previous design procedures. Sound insulation calculations are based on the characteristics of the aircraft noise, the sound insulation ratings and the areas of the various facade elements. To be accurate, and meaningful, the calculations must be repeated for a wide range of frequencies and take into consideration differences between laboratory and field conditions.

The new software includes a database of more than 100 sound insulation measurements and allows the user to compare various design solutions to quickly and conveniently arrive at an optimum design. Users can add new sound insulation and aircraft noise data, making the program even more useful. In addition to calculations in decibels, there will be audible simulations of aircraft sounds experienced indoors for selected design examples. This means that the user will be able to listen to the differences between design options as well as look at the numbers.

All components of the project, including the software and an accompanying manual, are expected to be complete by mid-2001 and will be made available for a nominal fee. Notification of availability will be provided in *Construction Innovation*.

If you have specific questions or would like to purchase the report, please contact Dr. John Bradley at (613) 993-9747, fax (613) 954-1495, or e-mail john.bradley@nrc.ca.

The project was undertaken with the support of the Department of National Defence, Transport Canada and the National Research Council, with additional support from Vancouver International Airport.

What we're hearing

University of Toronto offers new building sciences program

The University of Toronto is offering a new Building Science Certificate program, which overlaps many traditional disciplines, including structural, mechanical and environmental engineering, architecture, material science, public health, construction, and interior design.

This new program will be of particular interest to firms that provide building design or design review services, investigate building problems and recommend remedial repairs, develop long-term capital cost plans for building portfolios, or that construct buildings of any kind.

The program commences in February 2001 and consists of modules in building science fundamentals, exterior wall systems, window and curtain wall systems, roof systems, concrete structures, HVAC systems, and contract administration and liability. Participants must successfully complete six of the eight modules to receive the Certificate.

Please visit ***www.pdc.utoronto.ca*** *for more information about admission requirements, course descriptions, dates and costs, or call (416) 946-7256 or 1 888 233-8638.*

Roadmap will point way for future intelligent buildings technologies

Continued from page 10

Canada (NRCan), Canada Mortgage and Housing Corporation (CMHC), and the National Research Council (NRC) through its Institute for Research in Construction (IRC). The project consultant is IBI Technology.

IRC has championed the creation of the roadmap from the outset and encouraged stakeholder participation. Among the key participants is the Continental Automated Buildings Association (CABA), the project manager. The steering committee is comprised of representatives from Bell Canada, Honeywell, Hydro-Québec, IBM, NRC, NRCan, Nortel Networks, PWGSC, Siemens and Tridel Corporation — names which illustrate the broad range of interests in the project, as well as its international significance.

"This important public-private sector roadmap project on intelligent buildings technologies will be an important resource, providing timely information to end users (building owners, operators, and managers) of this technology," says Ron Zimmer, CABA President and CEO.

When the roadmap is completed, it will be publicly available for the benefit of all stakeholders in Canada and abroad.

Specific questions can be directed to Mr. Chris Norris at (613) 993-0125, fax (613) 941-0822, or e-mail chris.norris@nrc.ca.

Upcoming events

MARCH

23-24
MecanEx 2001. Canadian Institute of Plumbing and Heating (CIPH) and the Corporation of Master Pipe-Mechanics of Quebec (CMMTQ). Montreal. www.salonmecanexshow.com

APRIL

2-6
CIB World Congress. Wellington, NZ. http://www.branz.org.nz/cib

9-11
Building Tomorrow's Future. International and National Partners. Australian Building Codes Board. Marriott Resort, Surfers Paradise, Australia.
Tel: +61 2 6213 7298
E-mail: Bindi.Wilson@abcb.gov.au

MAY

21-23
Structures 2001: Structural Engineering Congress, Washington, DC. http://www.asce.org/conferences/structures2001/index.html

May 30-June 2
29th Annual Conference of the Canadian Society for Civil Engineering, 2001, Victoria. http://www.csce.ca/index.html

JUNE

3-7
18th Canadian Congress of Applied Mechanics – CANCAM 2001. St. John's. http://www.engr.mun.ca/conferences/conappmech/index.html

4-6
9th Canadian Masonry Symposium. Fredericton. www.unb.ca/web/mason/9cms.htm

10-13
International Conference on Underground Infrastructure Research, Kitchener, UIR Organizing Committee
Tel: (519) 888-4770
Fax: (519) 746-6556
uir2001@sunburn.uwaterloo.ca
http://www.civil.uwaterloo.ca/uir2001/ns/default.htm

11-13
Rapid Excavation and Tunneling Conference. San Diego. http://www.smenet.org/meetings/RETC2001.html

17-21
AWWA Annual Conference and Exhibition, American Water Works Association. Washington, DC. http://www.awwa.org/ace2001/index.html

26-29
The International Conference on Building Envelope Systems and Technologies (ICBEST). Ottawa. www.nrc.ca/ICBEST

AUGUST

5-8
IESNA Annual Conference. Ottawa. Contact: Valerie Landers at (212) 248-5000, ext. 117; www.iesna.org

construction innovation

Construction Innovation is published quarterly by the NRC's Institute for Research in Construction.

ISSN 1203-2743

Editor: Jane Swartz

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