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An Update on Selected IRC Research Projects

By Jim Gallagher and Sarah Mangione

The National Research Council's Institute for Research in Construction (IRC) is Canada's leading construction research agency. IRC conducts research in four principal fields: Building Envelope and Structure, Indoor Environment, Fire Risk Management, and Urban Infrastructure Rehabilitation. The Institute also plays a leading role in building code development and fosters innovation through its product evaluation service.

The following are synopses of IRC projects that may be of interest to CABA members.

Indoor Environment

Cost-effective Open-Plan Environments (COPE)

The goal of COPE is to evaluate objectively the effects of open-plan office design choices (such as workstation size, partition height, and surface properties) on the physical environment (air quality, thermal comfort, acoustics, and lighting). It also seeks to evaluate the effects of these environmental changes on occupant satisfaction with privacy, the environment, and their jobs. The evaluations are done by means of experiments in mock-up office laboratories, simulations, field studies, and literature reviews. The results are translated into guidance and software tools to aid decision-makers in choosing design options that both minimize expenditures and the risk of occupant dissatisfaction. A consortium comprising partners from both the public and private sectors is supporting the work. The project is nearing completion. Plans are currently underway to launch a comprehensive technology transfer program in 2004.

For more information see http://irc.nrc-cnrc.gc.ca/ie/cope

Information: Dr. Guy Newsham (613-993-9607)

Material Emissions and Indoor Air Quality

IRC is now well into Phase II of a project designed to provide a significant body of new information about materials, their emissions, and their effects on indoor air quality and occupant health. A target VOC (volatile organic compound) list of 90 compounds has been finalized and approved by the project's Health and End-User Advisory Committee. The list includes VOCs known to exist indoors, those known to be emitted from various materials, and, especially, those known to have health effects. Currently, researchers are re-analyzing the existing data from 48 of the materials to determine emission rates of the compounds on the target list. Three new building materials have been tested: oriented strand board, a natural linoleum assembly, and a laminated flooring assembly.

The following Web site contains more details: http://irc.nrc-cnrc.gc.ca/ie/iaq/cmeiaq.html

Information: Dr. Doyun Won (613-993-9538)

Software for Insulating Buildings Against Noise from Aircraft (IBANA)

IRC recently developed a design tool to assist architects and engineers in insulating houses and other wood-frame buildings against noise from aircraft. The software works by comparing various design options, either graphically or by listening to simulated indoor aircraft noises. It includes a database of more than 100 sound insulation measurements that allow users to compare various design solutions and to choose an optimum design quickly and conveniently. 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. The software, along with its database, is being sold as a CD accompanied by a printed manual. It is hoped that the software can be expanded to address other types of outdoor sounds and other building types.

More details are available at: http://irc.nrc-cnrc.gc.ca/newsletter/v6no1/aircraft_e.html

Information: Dr. John Bradley (613-993-9747)

Lightswitch Wizard

IRC lighting researchers and Natural Resources Canada's Buildings Group have released an online daylighting analysis tool called the *Lightswitch Wizard.* The tool has been developed to support daylighting-related design decisions in commercial buildings during an early design stage. It offers a comparative, reliable and fast analysis of the amount of daylight available in peripheral private offices as well as the lighting energy performance of automated lighting controls (occupancy sensors, photocells) compared to standard on/off switches. Blinds are either manually or automatically controlled. A simulation should take between 20 seconds and three minutes to run, assuming moderate traffic on the server and a fast Internet connection.

To access this tool, go to: http://www.buildwiz.com/

Information: Dr. Christoph Reinhart (613-993-9703)

Dynamic Daylight Simulations (DAYSIM)

Lighting researchers have been working on enhancements to DAYSIM, a RADIANCE-based dynamic daylight simulation method used to calculate the short-time-step development of indoor illuminances. The method is based on hourly mean direct and diffuse irradiance values. This information can also be used to calculate the daylight autonomy or artificial lighting demands in a building. In other words, DAYSIM uses the RADIANCE (a suite of programs that performs an analysis and visualization of lighting in design) simulation environment to predict indoor illuminances under multiple sky

conditions. DAYSIM will also perform an evaluation of the annual daylight availability in a building either during the initial design phase or later.

DAYSIM can be downloaded at http://irc.nrc-cnrc.gc.ca/ie/light/daysim.html

Information: Dr. Christoph Reinhart (613-993-9703)

SkyVision : Software Tool for Predicting Skylight Performance

Skylights are an attractive feature in buildings, but if poorly designed, they may lead to increased energy consumption and other problems. IRC, in collaboration with Natural Resources Canada and Public Works and Government Services Canada, is developing SkyVision, a skylight design software tool that will help skylight manufacturers, designers and builders select appropriate skylights. The software calculates the optical and thermal characteristics of various shapes and types of skylights, predicting their daylighting performance and energy-saving potential.

The beta version of the software is available at:
http://irc.nrc-cnrc.gc.ca/ie/light/skyvision/download.html

Information: Dr. Aziz Laouadi (613-990-6868)

Micro Combined Heat and Power Technology Assessment

Fuel cell core technology has the potential to make small distributed combined heat and power (micro CHP) plants that can generate electricity and heat at the single household level a viable alternative to large power generating stations. Once the fuel cell core technology is developed, issues such as CHP system sizing, storage, meeting peak loads, and dissipation of excess heat will need to be addressed in preparation for integration into residential electrical and heating (HVAC) systems.

To advance the testing of fuel cell technology, IRC and Natural Resources Canada (NRCan) have modified the two research houses at the Canadian Centre for Housing Technology (CCHT) to allow quick installation and testing of micro CHP systems. The performance capability of CCHT as a micro CHP testing tool has been demonstrated and proven by installing and testing an early micro cogeneration system that is currently available.

The result is a proven, highly sophisticated “micro CHP-ready” test facility with the capability to assess residential micro CHP systems (particularly fuel cell based systems) and their integration into houses, in real-world conditions.

Information: Michael Swinton, IRC (613-993-9708) or Michael Bell, NRCan (905-278 8360).

Fire Risk Management

Recognition of Temporal-Three Evacuation Signal

The 1995 National Building Code of Canada requires that fire alarm signals sound the temporal-three (T-3) pattern, as defined by the ISO standard 8201 "Acoustics - Audible Emergency Evacuation Signal." It is likely that the T-3 pattern will become the standardized alarm signal heard around the world, one that unequivocally means "*evacuate the building immediately,*" to quote the standard. Although new and refurbished buildings have, for the past few years, been equipped with this new signal, an IRC study found low public recognition of the signal.

For information on the study and the results, see:
http://irc.nrc-cnrc.gc.ca/newsletter/v6no4/evacuation_e.html

Information: Dr. Guylène Proulx (613-993-9634)

Water Mist Fire Suppression Technology

IRC has been studying the use of water mist fire suppression technology for more than 10 years. Water mist delivers a small amount of water with large surface area to control and extinguish fires. The approach requires less water than conventional sprinklers, thereby reducing water damage to the building and its contents. Water mist has been shown to be suitable for most types of fires, including those involving flammable liquids, electrical equipment, wood and paper, and cooking oils. Water mist systems have a wide range of use for both standard applications such as office and residential buildings, as well as for specialized situations such as industrial 'clean rooms,' medical centres, telecommunications facilities, machinery spaces and commercial cooking areas.

More details are available at:
http://irc.nrc-cnrc.gc.ca/newsletter/v6no1/extinguisher_e.html

Information: Dr. Zhigang Liu (613) 990-5075

Research on Plenum Cable Fires

With the increasing use of computers connected by local area network (LAN) systems in recent years, there have been concerns in the codes and standards community regarding the amount of cable installed in unducted HVAC return air plenums. IRC is working on a project to evaluate the hazard to human life of fires involving communication cables in above-ceiling plenums. The project will develop information that can be used as input to performance test standards and codes. The final report will include a hazard analysis to determine the potential impact of the increasing quantities of wire and cable installed in HVAC return air plenums.

Information: Dr. Gary Lougheed (613-993-3762)

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