Session XI-B: Whole Buildings—Construction

Wednesday, December 8, 2004
3:30 p.m. to 5:00 p.m.
Grand Ballroom – Palm

Session Chair:

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3:30 p.m. to 3:40 p.m. Introduction
George Crow

3:40 p.m. to 4:00 p.m. *"The Building Developer's Requirements, Management, and Verification to Ensure Dry Buildings by Moisture Control"*
Eva Sikander

4:00 p.m. to 4:20 p.m. *"Impact on Implementation of Retrofit Measures By Including Infrared Thermography in Energy Auditing"*
Dominique Derome

4:20 p.m. to 4:40 p.m. *"Airtightness of Timber-Framed Houses with Different Structural Solutions"*
Minna Korpi

4:40 p.m. to 5:00 p.m. *"Airtightness Performance of Wood-Framed Houses Over a 14-Year Period"*
Gary Proskiw

5:00 p.m. to 5:20 p.m. *"Reducing the Energy Consumption of Existing Houses by 40%"*
Tom MacDermott

The Building Developer's Requirements, Management, and Verification to Ensure Dry Buildings by Moisture Control

Eva Sikander and Per Ingvar Sandberg – *SP Swedish National Testing and Research Institute*

Jörgen Grantén – *WSP Environmental*

If moisture damage occurs in a building, it is often serious for both the property owner and for the occupier/user. It can, for example, give rise to unpleasant smells and ill health. In addition, it can be very expensive to correct such damage. Therefore, there is every reason to attempt to reduce the risk of moisture damage arising in the first place.

The property developer plays a key role in ensuring good moisture control. It is the developer, for example, who can specify appropriate requirements in this respect before building starts. If this is to produce successful results, it is also most important that the application of the specified requirements be carefully monitored and checked. Today, there is very little to assist the developer in doing so, whether during the construction stage or during use of the building. The purpose of this paper is to describe proposals for appropriate specifications, management, and verification by the building developer in order to ensure production of a dry building.

Impact on Implementation of Retrofit Measures By Including Infrared Thermography in Energy Auditing

D. Derome and M. Bérubé-Dufour – *Concordia University*

G. Desmarais – *Trow*

J.-P. Finet – *Fonds en efficacité énergétique*

Energy auditing of existing buildings, e.g., the EnerGuide for Houses in Canada, especially under the impetus of utility companies and government agencies, is becoming widespread. It has been noticed, however, that recommendations from such audits regarding the building envelope are either nonexistent or not implemented by building owners. A pilot project including various types of buildings, i.e., 22 single-family houses, 8 multi-unit residential buildings, and 15 commercial and institutional buildings, was developed to evaluate the impact of including an infrared thermographic analysis to the traditional energy efficiency auditing in terms of implementation of recommended measures and identification of additional energy savings.

The two main technical aspects of the project aimed at evaluating: the additional potential energy savings resulting from an increased motivation of the building owners or managers to reduce building envelope heat losses following the infrared analysis compared to their motivation following a traditional energy efficiency audit and the efficiency of infrared thermography to target energy efficiency measures compared to the targeted measures resulting from traditional energy efficiency audits.

This paper presents the criteria used for building selection, the protocol developed for the infrared thermography analysis, the interviews, and analysis of the energy impact of recommended measures. The results of the study present the added value brought by the use of thermographic analysis in terms of added energy savings vs. cost of measures. The latest results indicate that the extra cost of adding thermography is counterbalanced by the efficiency of thermography to detect weak points in the envelope and to convince owners of the energy savings potential. This program was developed and supported by the Energy Efficiency Fund, whose mandate is to promote energy efficiency among buildings heated by natural gas.

Airtightness of Timber-Framed Houses with Different Structural Solutions

Minna Korpi and Juha Vinha – *Tampere University of Technology*

Jarek Kurnitski – *Helsinki University of Technology*

Timber-framed buildings are being studied in Finland in a large-scale study by Tampere University of Technology and Helsinki University of Technology. This paper is based on the measurements of airtightness done in 100 Finnish single-family houses by the fan pressurization method in the years 2002 and 2003.

The mean air change rate at 50 Pa (0.201 in. of water) of the 100 dwellings was 3.9 1/h. It was noticed that the method of construction and the materials used in wall and ceiling assemblies had at least some influence on the level of airtightness. It was also noticed that the airtightness of buildings with a mechanical supply and exhaust ventilation system does not satisfy the recommended level of airtightness in Finland. In addition to structural solutions, airtightness depends on construction quality. In this study, good airtightness was achieved with many different structural solutions.

Airtightness Performance of Wood-Framed Houses Over a 14-Year Period

Gary Proskiw – *Proskiw Engineering Ltd.*

Anil Parekh – *Natural Resources Canada*

This paper summarizes the most recent results from an ongoing, multi-year research program to monitor the long-term performance of residential air barrier systems. Airtightness tests were conducted on 22 wood-frame houses, ranging in age from 10 to 14 years, for which there was extensive historical airtightness and construction data. Nine of the houses used polyethylene air barrier systems and 13 used an early version of the airtight drywall approach (ADA). The latest tests were conducted in early 2000. All of the houses were located in Winnipeg, Canada.

The results of the 2000 tests showed that the average airtightness of the nine houses constructed with polyethylene air barriers deteriorated very slightly over the monitoring period. For example, the median and mean increases in the measured air change rate at 50 Pa (ac/hr50) between the first and last tests were 0.16 ac/hr50 and 0.21 ac/hr50, or 15% and 30%, respectively. The median and mean increases in the normalized leakage area at 10 Pa (NLA10) were 0.075 cm2/m2 (0.108 in.2/100 ft2) and 0.112 cm2/m2 (0.161 in.2/100 ft2), or 11% and 35%, respectively. However, examinations conducted during the tests showed that much of the major air leakage observed in the 2000 tests occurred at accessible locations not directly associated with the polyethylene portions of the air barrier system, such as at floor drains, doors and windows, and mechanical and electrical penetrations through the envelope. Based on these observations, it was concluded that no evidence was found to indicate that polyethylene is unsuited for use as an air barrier material in residential, wood-frame construction.

The 13 ADA houses behaved in a similar fashion, although their degradation was slightly more pronounced than the polyethylene houses. The median and mean increases in the measured ac/hr50 values between the first and last tests were 0.40 ac/hr50 and 0.38 ac/hr50, or 38% and 38%. The median and mean increases in the NLA10 were 0.157 cm2/m2 (0.226 in.2/100 ft2) and 0.150 cm2/m2 (0.216 in.2/100 ft2), or 39% and 41%, respectively. Once again, much of the leakage occurred at accessible locations not directly associated with the ADA portions of the air barriers. Overall, it was concluded that no evidence was found to indicate that the ADA system is unsuited for use in residential, wood-frame construction.

Reducing the Energy Consumption of Existing Houses by 40%

Thomas J.L. MacDermott, Robert S. Dumont, Jerry T. Makohon, and Larry J. Snodgrass

Saskatchewan Research Council

Don Fugler – *Canada Mortgage and Housing Corporation*

This paper describes the results of a project that studied the reduction of purchased energy of existing houses by 40% with the cost of the retrofit measures being acceptable to the homeowners. The five houses examined in this project are located in Saskatoon, Saskatchewan, Canada. The houses varied in age, being built between 1911 and 1986, and contained a wide variety of styles, occupancies, etc. After one year of post-retrofit monitoring, the total energy consumption (electricity and natural gas) of the houses was reduced by up to 39.6%.