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## **NRC-IRC Guidelines for Basements Released**

By Mike Swinton and John Burrows

Though they can be subject to greater structural, water and moisture loads than the above-grade portions of a house, basements are often underrated or overlooked in terms of their construction. In fact, the basement is an integral part of many North American homes, with consumers in Canada often expecting basements to provide livable space of the same quality as the rest of the dwelling.

Given the diversity of soil and climatic conditions faced by builders across Canada, it is not always easy to achieve successful basement construction. Problems can occur if constructions are not well understood and not well suited for the particular local conditions, as evidenced by the incidence of claims under new home warranty programs.

Within the spectrum of site conditions across the country, builders can come across ideal situations for building basements; for example there can be large lot sizes and natural slopes that allow surface drainage away from the house in all directions, local soils can be free draining and stable, the water table can be well below the footings, and the local climate can be relatively dry most of the time. In such conditions a very basic basement configuration meeting minimum code requirements can perform adequately. Nevertheless, it is improbable that all of those favourable conditions exist at every construction site. When the builder is dealing with one, some or many challenging conditions in a given location, consideration should be given to additional measures that may be needed beyond the code minimum to address those challenging site conditions.

In order to provide better guidance and more options for builders in this regard, the NRC Institute for Research in Construction undertook a major study of basement design and construction in the late 1990s. This work culminated in the development and recent release of a comprehensive document *Performance Guidelines for Basement Envelope Systems and Materials*.

### **Study Objective and General Findings**

The objective of the study was to develop design principles to assist in the development and specification of basement envelope and material systems that perform better and last longer, for the broad range of Canadian climates, soil conditions and indoor environments. This was achieved by reviewing the performance requirements of the basement envelope and its related systems, reviewing the performance capabilities of available constructions systems, and finally, sorting out the host of regulatory requirements that must be met by the building materials and systems.

The *Guidelines* record the technical rationale for specifying particular basement envelope materials and systems based on the best information available today. In so doing, they provide a communication link between materials manufacturers and

designers, specifiers, builders and their sub-contractors involved in the construction of residential basements. Some of the major findings can be summarized as follows:

- Performance expectations for environmental separation have become more demanding as basements have been used more and more as living space. The notion of classifying basements by their intended use and function is introduced to help designers identify which basement envelope functions need to be stressed to achieve the intended use of the basement. As well, once the class of basement is identified, a consumer can understand the intent of original design, which manages consumer expectations and permits better basements to be valued properly. For instance, 'Class A' basements are intended to be finished livable spaces, and all of the functions of the envelope need to be addressed well. A 'Class E' basement is a purely structural foundation with essentially no environmental separation. Both can meet code, but the intended use defines the functional requirements, and the consumer can then understand how much was planned into the basement envelope to achieve its intended use.
- The National Building Code of Canada and applicable provincial codes cannot possibly cover all the variations of conditions for basements. This leaves considerable decision-making responsibility to the designer or builder. The Guidelines advocate that designers and builders carefully consider material and equipment selection within the context of the actual site and environmental exposure conditions where the basement will be constructed, and in conjunction with its intended use and occupancy. In most cases, exceeding minimum code requirements will be necessary to achieve acceptable levels of performance corresponding to modern consumer expectations, especially for 'Class A' finished basements.
- Basement envelopes featuring multiple materials must generally be specified to make sure that all of the functional requirements expected of the envelope are covered by at least one of those materials or system of materials, and that all of the materials are working together as a system.
- Designers and builders need to understand the intended roles of the materials and systems to ensure assembly techniques don't defeat the intended properties or function of the materials and systems.
- There are many different approaches to building a basement envelope and more are emerging every year. Some may be more appropriate than others to achieve the intended performance at the lowest feasible cost to the consumer.
- There is a balance to be achieved between first cost, cost of repair (including warranty work), and cost of maintenance and operation. That balance changes with conditions. The *Guidelines* propose approaches for achieving a good balance.

## **The Guidelines**

The *Guidelines* are organized as follows:

*Part 1 – Performance Requirements for Basements* – defines the general expectations of basement function and performance, and introduces the concept of 'Basement Class' as a means of identifying the intended use of the basement. This part also includes the technical performance requirements – the structural requirements, the environmental

separation functions, and the qualitative properties of the envelope system such as buildability and durability.

*Part 2 – Basement Envelope System Selection* – reviews the basement envelope systems that can be selected to address the performance requirements. Environmental conditions (inside and out) and occupant expectations, combined with the selected envelope system, determines the performance requirements of the materials to be used within the construction system.

*Part 3 – Selection of Materials and Equipment for the Basement System* – identifies the roles of the materials within the envelope system and indicates what performance characteristics have to be met by those materials for their given roles.

*Part 4 – Critical Design Details* – addresses some key detailing issues such as the wall-soil interface and window well detailing.

*Part 5 – Quality Assurance* – reviews various quality control tools available to the Canadian construction industry.

*Part 6 – Basement System Cost/Benefit Analysis* – introduces the concept of cost/benefit analysis as a planning tool for achieving a balance between long-term basement performance and first cost, for a range of scenarios and locations.

The *Guidelines* were developed under the guidance of a Steering Committee composed of industry associations and government agency representatives. This committee oversaw the development of the *Guidelines* and ensured that they reflect the best collective knowledge of Canadian industry and related public and private agencies. The NRC Institute for Research in Construction wishes to thank all those who contributed to the project.

The complete report, *Performance Guidelines for Basement Envelope Systems and Materials*, has been released and is available at no cost at:

[http://irc.nrc-cnrc.gc.ca/pubs/rr/rr199/index\\_e.html](http://irc.nrc-cnrc.gc.ca/pubs/rr/rr199/index_e.html)

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