



Basements: back to basics

NRCC-50577

Swinton, M.

A version of this document is published in / Une version de ce document se trouve dans:
Home Builder, v. 21, no. 4, July/August 2008, p. 12

The material in this document is covered by the provisions of the Copyright Act, by Canadian laws, policies, regulations and international agreements. Such provisions serve to identify the information source and, in specific instances, to prohibit reproduction of materials without written permission. For more information visit <http://laws.justice.gc.ca/en/showtdm/cs/C-42>

Les renseignements dans ce document sont protégés par la Loi sur le droit d'auteur, par les lois, les politiques et les règlements du Canada et des accords internationaux. Ces dispositions permettent d'identifier la source de l'information et, dans certains cas, d'interdire la copie de documents sans permission écrite. Pour obtenir de plus amples renseignements : <http://lois.justice.gc.ca/fr/showtdm/cs/C-42>



National Research
Council Canada

Conseil national
de recherches Canada

Canada

Basements – Back to Basics

By Mike Swinton

Consumer expectations for basements in houses have increased in the last few decades. Basements are being used more and more as living spaces and thus require the same degree of temperature and humidity comfort as the rest of the house. This means that, more than ever, they need to stay dry.

The causes of basement moisture problems are mainly external, and they can be avoided by diverting water away from the building, providing drainage along the basement perimeter, protecting the foundation walls against moisture, and by ensuring effective grading around the foundation and over the entire lot.

A major study carried out by the National Research Council Institute for Research in Construction (NRC-IRC) reinforces conventional wisdom that links long-term basement performance to proper site grading and foundation drainage. This article summarizes some key basic principles from that study.

Moisture in Basements

Basement moisture problems that originate from the exterior can be caused by leakage, water migration through the foundation walls and floor, sump pump failure and sewer backup.

Leakage is prevented by directing water away from a foundation by means of site grading and providing drainage around the foundation perimeter, or by waterproofing the foundation. Most foundations in new Canadian houses feature footing drainage systems with complementary wall and floor dampproofing. This approach normally makes waterproofing unnecessary.

Basement protection against exterior water is based on the following principles:

1. Site grading and drainage provide the first line of defence against exterior water entering the basement.
2. Foundation drainage (weeping tile and/or a granular drainage layer), combined with effective drainage around the basement walls and appropriate moisture protection of the below-grade basement envelope surfaces, provides the second line of defence.
3. The use of special design details and building in factors of safety are ways of addressing weak links in the basement envelope.
4. The selection of proper materials is essential for basement performance.

Site Grading and Drainage

Improper lot grading can direct water toward the foundation, causing water leakage or settlement. It is one of the main reasons for customer dissatisfaction and call-backs for builders.

Most surface drainage problems occur between houses, especially where houses are close together. A well-defined swale between the houses should be constructed to allow surface water to be diverted away from the houses, and downspouts should discharge at least 1 m (3 ft) away from foundations and be directed away from a house and adjacent, neighbouring houses.

There are also specific guidelines that should be followed with respect to the minimum height of the foundation wall above grade; the minimum slope away from the house; the minimum slope on the rest of the lot; the minimum elevation of the lot above street level, at the house; the minimum depth of swales; the direction of surface drainage relative to certain building or landscaping features; the impact of landscaping and fencing projects on planned elevations at the site perimeter.

The site grading and drainage plan should be put in place prior to construction but cannot be executed until construction is complete.

Foundation Drainage and Moisture Protection

Designing to keep water out of the foundation drainage system is crucial. This involves taking measures such as providing adequate slope away from the building, as well as an impermeable cap. Any water that can't be directed away from the building through site grading and drainage must be dealt with by the foundation drainage system.

Proper foundation drainage requires a path to convey water to the bottom of the foundation wall and a drainage system to take the water away. Both free-draining backfill and drainage membranes provide a vertical path that allows the water along the soil/wall interface to drain (see figures, last page), with the dampproofing membrane or coating providing additional protection.

Foundation drainage is usually composed of drainpipe (also known as weeping tile) installed around the perimeter of the foundation wall footing and covered with granular material prior to backfilling. When there are long runs of drainpipe, flow through the pipe can be maximized by using a second connection to the storm sewer or sump pump. Placing the drainpipe on a layer of free-draining material can offer better flow because any silt deposition will occur in the granular material rather than in the pipe.

Special Design and Construction Measures

In the construction of basements, there are often features, or situations, that require special methods, materials, or equipment. Two of the most common are window wells and sump pumps.

Window wells pose design and construction challenges because they are usually below grade, accumulate snow and surface water, and the window units they surround are not designed to resist hydrostatic pressure. Water in the window well needs to be conducted to the horizontal weeping tile by means of a vertical drainpipe and granular material, and the ground surface inside the window well should be well below the bottom of the window opening.

Sump pumps are often a key part of the drainage system used to help control the groundwater level. Preventing sump pump failure involves the careful consideration of various factors such as the area and configuration of the basement (to determine how many sump pumps will be needed and where they should be located), the permeability of the soil, and the provision of adequate back-up, especially when the basement is used as a living space.

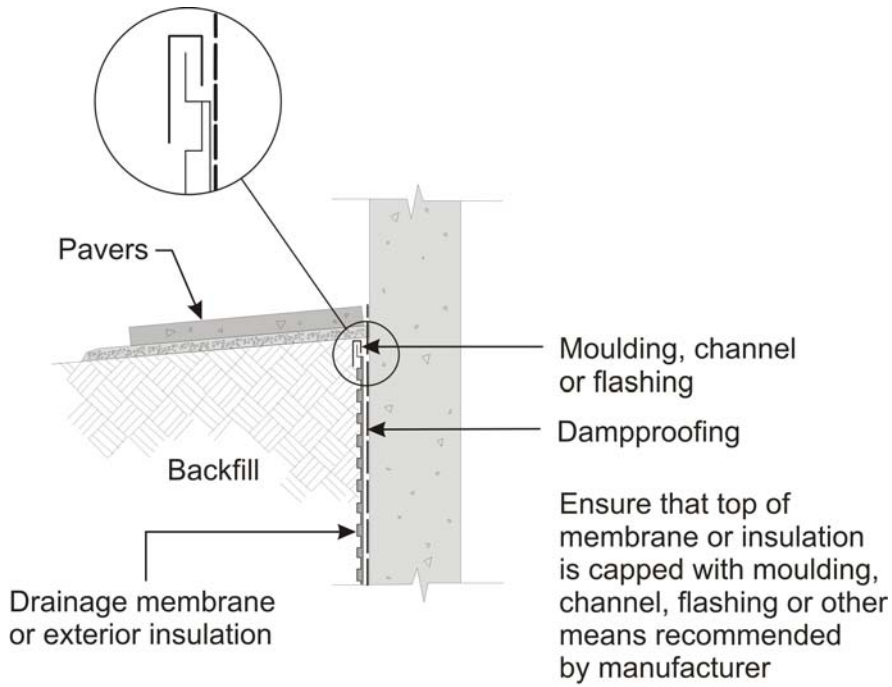
This article was drawn from the NRC-IRC publication *Site Grading and Drainage to Achieve High-Performance Basements*, Construction Technology Update No. 69, available on the NRC-IRC Web site at http://irc.nrc-cnrc.gc.ca/pubs/ctus/index_e.html.

The full report from the basement study is available at:
http://irc.nrc-cnrc.gc.ca/pubs/rr/rr199/index_e.html

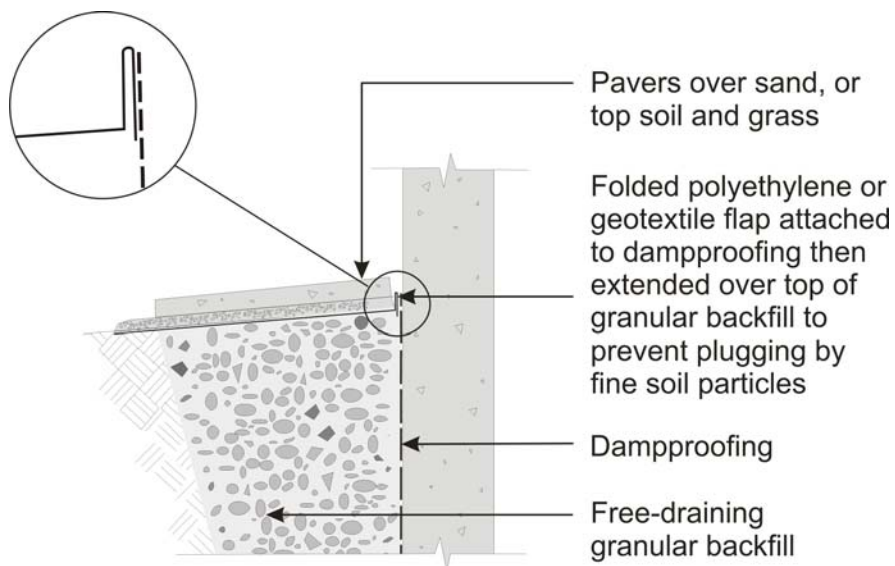
The NRC-IRC cross-Canada seminar series for 2008/09, entitled *Single and Multi-Family Houses: Improving Performance Through a Systems Approach*, will include presentations on basement construction. For details, visit www.bsi.gc.ca.

Mike Swinton is a principal research officer in the Building Envelope and Structure program at NRC-IRC, Canada's leader in construction research. E-mail: mike.swinton@nrc-cnrc.gc.ca

Figures



Drainage membrane or insulation



Granular drainage layer