RESEARCH HIGHLIGHTS

Technical Series 99-109

BASEMENT WALLS THAT DRY QUICKLY

Introduction

There are many ways basements can get wet - floods, plumbing leaks, wall leaks, etc. The consequences of wetting can be very serious. Water can damage furniture or the basement walls, requiring their replacement. Excessive water can also lead to mold growth in the basement, which may cause health problems to the house occupants. If water entry does occur, are there basement wall systems that dry more quickly and safely than others?

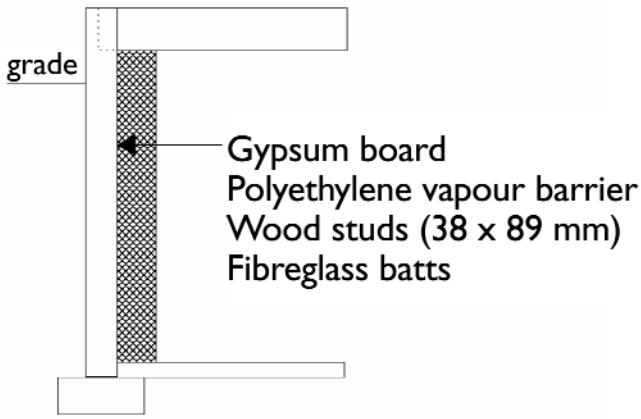
CMHC has conducted an eighteen month study to test different basement wall systems and identify those that dry quickly. Walls that drain and dry easily might survive intermittent wetting episodes and prevent the growth of molds.

Research Program

Ten different basement wall systems were tested at the Alberta Home Heating Research Facility. Each wall system had sensors to measure moisture content and temperature at selected points in the wall cavity. The interior of the test house, including the basement zone was conditioned to a relative humidity (RH) in the range of 40 to 50% RH. The basement air temperature was set at 20˚C.

Two of the occurrences that may lead to basement dampness are water penetration through cracks in the basement walls and flooding. Both were tested. The two tests were a controlled leak behind each panel and the flooding of the basement to a depth of approximately 100 mm. After each wetting, the panels were monitored for a period of months to determined the drying characteristics. Throughout the testing period, each panel was removed and thoroughly examined periodically for evidence of mold growth. The surface moisture content at a number of selected locations was determined by a hand-held wood moisture meter.

Figure 1: Standard Construction Configuration



The wall systems evaluated consisted of five variations of conventional wood-framed construction, two steel stud construction and three proprietary systems. Of the three proprietary systems, one consisted of sprayed polyurethane over wood studs; it was only tested during the basement flood test.

Wall Systems Tested

1. **Standard Construction:** (As shown in Figure 1.) Consists of painted gypsum board, a 0.15 mm polyethylene vapour barrier, wood frame and fibreglass batt insulation. The bottom plate rests on the concrete floor.
2. **Improved Standard I:** In addition to standard Construction configuration, has a polyethylene sheet on the wall up to grade as a moisture barrier.

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3. **Improved Standard II:** Built with steel stud frame, and using a drywall alternative* that may offer some advantages in resistance to moisture damage. The bottom plate is raised 19 mm off the concrete floor.
4. **Improved Standard III:** In addition to Improved Standard III, framing is spaced off 19 mm from concrete wall.
5. **Proprietary Wall I:** Built with an extruded polystyrene that may allow water to drain between the insulation and the wall onto which it is applied, the drywall alternative, and 0.15 polyethylene vapour barrier.
6. **Proprietary Wall II:** Consisted of experimental panels of rigid glass fibre on a plastic frame.
7. **Improved Standard IV:** Differs from standard construction configuration by using the drywall alternative. The bottom plate is set 19 mm off of the concrete floor.
8. **Improved Standard V:** Built like Improved Standard I with alternative drywall product.
9. **Improved Standard VI:** Built like Improved Standard V with bottom plate set 19 mm off of the concrete floor.
10. **Proprietary Wall III:** Sprayed polyurethane insulation over a standard wood stud wall with the drywall alternative.

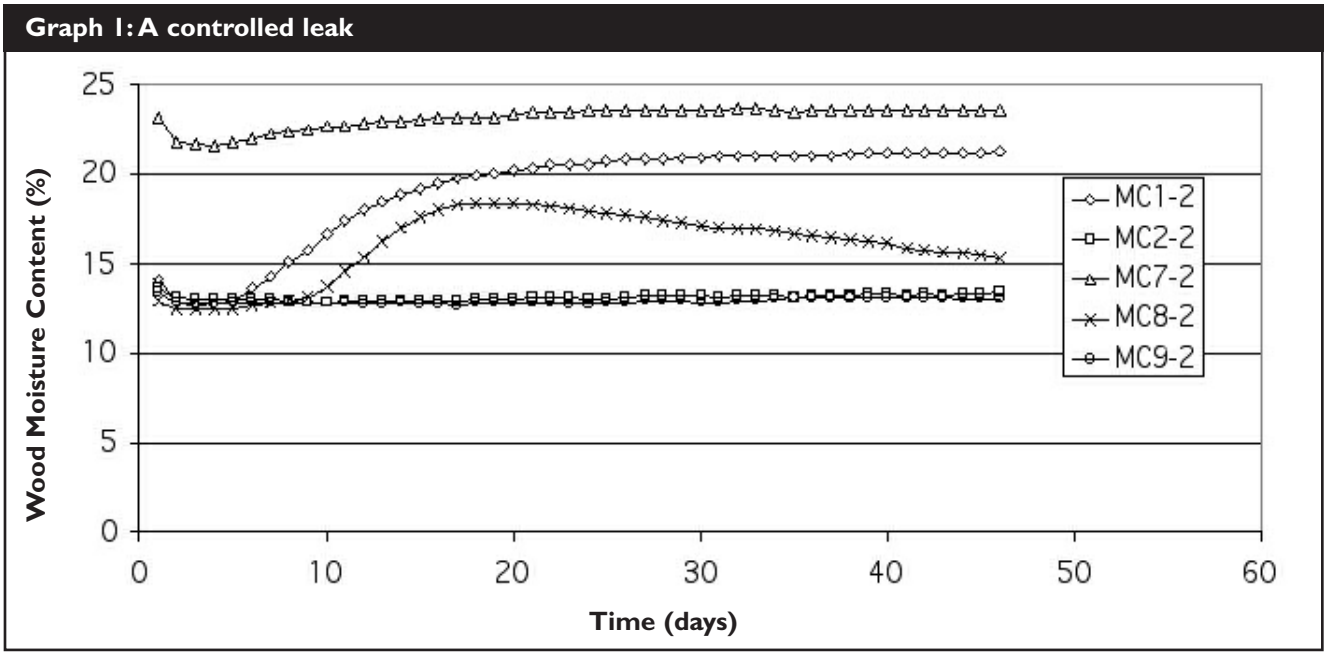
Findings

In general, all of the proprietary wall systems performed better than the wood-framed or steel-stud systems when subjected to both controlled leaks and short term floods. The proprietary systems either did not absorb significant amounts of moisture or dried relatively rapidly after wetting.

The following graphs show the wood moisture contact of the wall assemblies after a controlled leak (Graph 1) and a flood (Graph 2). These figures do not show the moisture performance for assemblies without wood. Sustained moisture contacts over 20% may provoke mold growth. Note that drying is slow in both the leak and flood situations.

The steel stud systems performed better than their wood-framed counterparts when subjected to a short term flood. The steel studs had no capability to retain moisture. However, the stud cavities remained damp due to retention of water by the insulation and polyethylene sheeting.

Graph 1: A controlled leak



* *The drywall alternative is a water resistant product, similar to gypsum board, that contains chopped fibres which help to maintain structural integrity under high moisture conditions.*

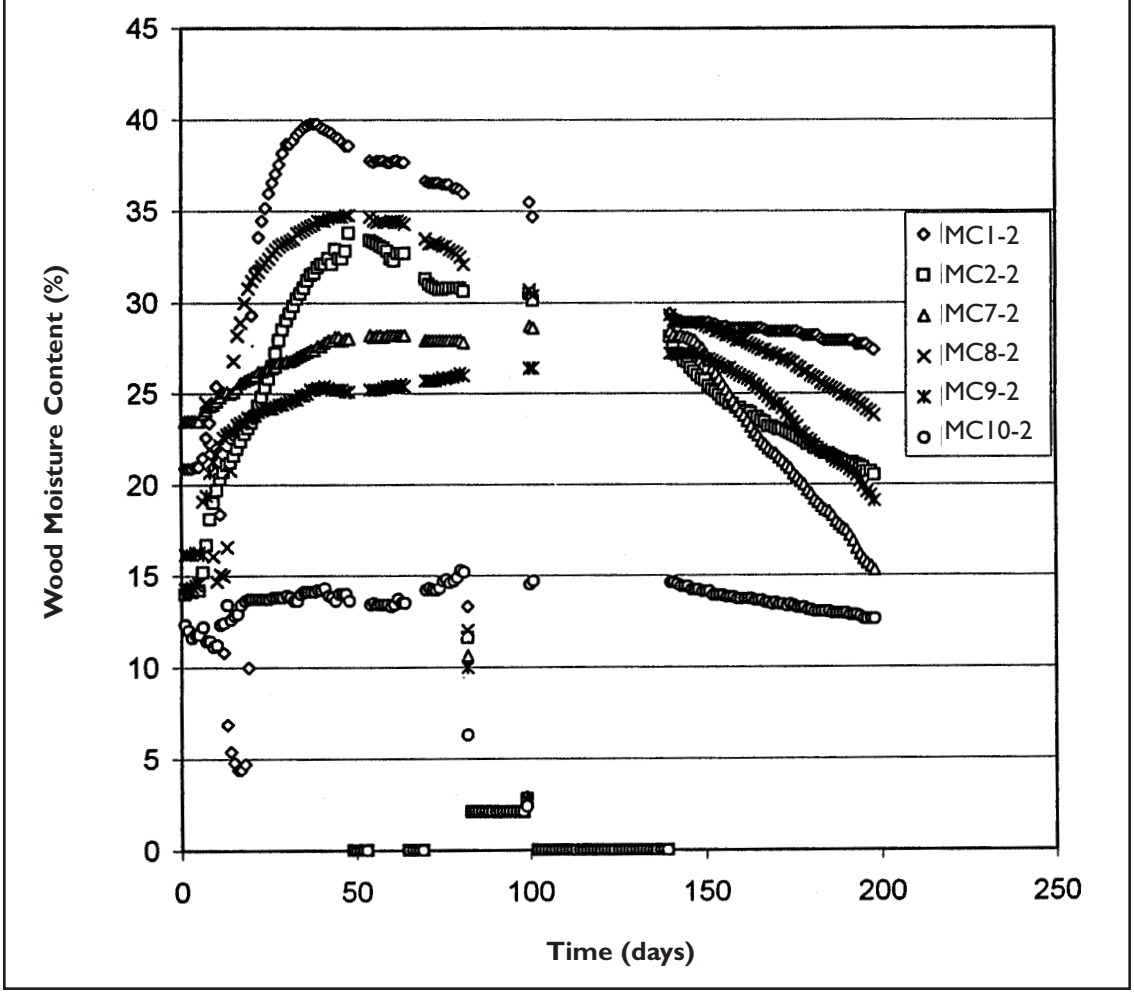
None of the alternative wood-framed systems appeared superior in either of the wetting tests. In the case of a controlled leak, the systems that had an external moisture barrier (ie. plastic against the concrete wall) caused the water to flow down the wall, under the bottom plate and into the basement. These systems appeared to offer superior performance because the wood was protected from the leak by design. However, it was not possible to perfectly seal the panels, nor was any real attempt made to do so. When the source of the moisture was a flood, the 100 mm of water found its way into all panels, regardless of whether a moisture barrier was present. Once in the panel, the moisture remained longer in those equipped with a moisture barrier. The moisture barrier inhibited moisture removal. During the controlled leak, the two of the proprietary wall systems tested, extruded polystyrene and rigid fibreglass, appeared to shed any moisture. Their performance was also superior during flooding. The rigid fibreglass drained very quickly and dried and both other systems, extruded polystyrene and sprayed polyurethane, did not initially absorb significant amounts of moisture. However, high levels of relative humidity remained for a long time in the cavities behind the extruded polystyrene and mold growth can still occur.

The study did not show significant growth of mold or mildew in any of the cavities. There was some minor darkening in the bottom plate of two of the wood framed panels. Conditions were generally favourable to mold growth but none occurred. This may be due to lack of spores which must be present to initiate growth.

Conclusions

The research showed that some wall systems seem to tolerate an occasional wall leak without significant wetting. However, standard or modified stud walls retained too much moisture to be safe during major wall leaks or flooding. Alternate wall systems had better moisture performance.

Graph 2: Flood



Project Manager: Don Fugler

Research Report: *Basement Walls that Dry, 1999*

Research Consultants: Tom W. Forest and Mark Y. Ackerman, University of Alberta

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700 Montreal Road
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