

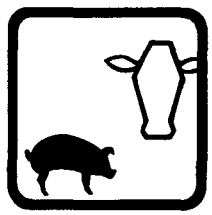

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Basement Moisture Problems

NOTE: This fact sheet summarizes and complements more in-depth information contained in *Correcting Basement Moisture Problems,* Special Report 2. This report is available for $1.05, check payable to the University of Minnesota, from your county extension office or the Bulletin Room, Coffey Hall, University of Minnesota, St. Paul, MN 55108.

Introduction

According to a recent census bureau survey, 125,000 Minnesota homeowners may experience basement water leakage on the average of at least once every three months. It is further estimated that half of all homeowners with basements have some type of moisture problem.

Homeowners who want to resolve their basement moisture problems are often frustrated by conflicting recommendations from reputable tradespeople and exaggerated claims from ill-trained salespeople of "magical" waterproofing techniques. Unfortunately, it is difficult to find applicable research or impartial, knowledgeable sources of information about the comparable merits of various remedies.

The prevalence of wet basements has left many owners with the pessimistic and incorrect opinion that concrete foundations naturally leak. There are many examples of floating concrete structures without waterproof membranes that do not leak: the Lake Washington Bridge, built in Seattle in 1941, which is a series of floating concrete boxes; concrete boats built a century ago in Europe; and concrete ships built in the United States during the two world wars. These examples clearly illustrate that concrete sturctures can be watertight, as can concrete block- and stone-mortar foundations.

Basic Forms of Moisture Transfer

To successfully prevent or correct basement moisture problems at a relatively reasonable cost, it is important first to understand how moisture is transferred through concrete and soil and second, to determine what form or forms of transfer are likely to occur or are already occurring in your basement. Following are the basic modes of moisture transfer.

1. *Hydrostatic pressure* is simply the pressurized flow of liquid moisture through pores, gaps, cracks, or seams. Most foundation leaks result *not* from an excessively high ground water table, but from saturation of the ground adjacent to the foundation due to snowmelt, rain, or excessive watering. For this reason, the first rule of basement moisture protection is proper drainage. Frequently, adequate drainage is simply a matter of diverting surface runoff away from the foundation via surface contours, downspouts and gutters, basement window well covers, or below-grade polyethylene or extruded polystyrene moisture deflectors. The most effective waterproofing system — and clearly the most prudent investment in new construction — involves an exterior membrane *and* exterior drain tile or tubing along the base of the foundation wall.

Occasionally, the soil adjacent to the foundation may be composed of an upper layer that is relatively permeable underlaid by a layer that is relatively impermeable. In these cases, water may move horizontally under the surface to create hydrostatic pressure along the foundation wall. Soil borings by a soil scientist or civil engineer are the *only* accurate way to determine to what degree, if any, soil texture (or groundwater table level) may be contributing to a basement moisture problem

Before investing thousands of dollars in basement improvement, a prudent owner and a highly professional contractor will have site soil borings completed by an independent engineer. Sometimes you can get free and helpful independent information about soil and water table conditions simply by visiting the local Soil Conservation Service (see telephone white pages, "U.S. Government Offices-Agriculture, Dept of") or the water-sewer division of your city's public works department.

2. *Capillary draw* is simply the flow of liquid moisture, without pressure or force, through small interconnected pores. Capillary transfer in concrete or masonry is similar in concept, but not in degree, to the absorption of a sponge, wick, or towel.

Capillary draw is dependent on two conditions. The first, an adjacent concentration of water, is usually due to snowmelt, rain, or lawn watering. Occasionally an adjacent water table may be the origin of liquid supporting capillary draw. The second factor, continuous interconnecting pores, involves both soil texture and particle size, as well as the quality and composition of the concrete or masonry and mortar. Some soils, such as finely textured clay and silt, may be saturated almost 6 feet above the water table* and may have a total liquid and vapor capillary rise of 12 feet. In contrast, gravel has no capillary rise, while coarse sand has a total capillary rise of less than 3 feet.

Soil borings are the *only* accurate way to determine to what degree, if any, soil conditions and, perhaps, groundwater table level, may be contributing to a capillary-caused moisture problem.

3. *Vapor pressure* is simply the pressurized flow of water vapor or gas from an area of high humidity to an area of lower humidity. Since warm air can hold a greater absolute amount of water vapor than cooler air, vapor pressure generally creates a vapor flow from warm to cooler areas. For this reason, in northern climates a vapor barrier is placed on the warm or interior side of above-grade floor, wall, and ceiling assemblies.

Below grade, when the basement has low relative humidity and the surrounding soil is saturated (100 percent relative humidity), water vapor may flow from the soil into your basement. For this reason, building codes require a vapor barrier on the soil or exterior side of below-grade floors and walls. In new construction, you should treat the exterior of the foundation wall below grade with impermeable material before backfilling. The base for the floor slab should also be treated before pouring. In remodeling, you should install a vapor barrier against the concrete or masonry floor and the below-grade wall before attaching furring strips.

In addition to water vapor flow from the soil to the interior, condensation may result from moisture-producing activities in the basement such as unventilated clothes-drying, showering, storing green firewood, and opening basement windows during hot, humid periods. In these situations, water vapor is created, which subsequently condenses on cool surfaces such as pipes, lower basement walls, and basement floor edges.

*Water table, in this case, refers to the point where water would stand in an uncased borehole.

Prevention of Basement Moisture Problems

It is much easier, less costly, and more efficient to install a waterproofing system when the basement is built than to correct a water problem. The most effective below-grade waterproofing system depends upon the following factors:

- Site conditions such as contours, watershed, natural drainage pathways, and flood plains should be assessed by a site analysis and contour map.
- Soil borings and analysis are critical for determining soil permeability, pH (acidity/alkalinity), salt content, expansive characteristics, and seasonal water table — all factors that influence the specific type and design of a waterproofing system. Information available from your local Soil Conservation Service may help in preliminary analysis, but does not replace the need for soil borings.
- Minimum life expectancy of a waterproofing system is established by the suitability of the materials for the specific conditions under which they are used and by the suitability of the application methods for the specific materials. Material manufacturers should submit independent test data from recognized testing laboratories, government agencies, or building code organizations to support performance claims and acceptable installation methods.
- Quality of concrete and masonry-mortar foundations is influenced by the water-cement ratio, cement content, air entrainment, mixing, placing, curing, footing design, and mortaring techniques. A quality-built foundation reduces waterproofing requirements, whereas a substandard foundation may require replacement before any water-protective system will be reasonable.
- Consequence of failure should be weighed. For example, occasional leakage and dampness may be acceptable if the basement is unfinished or not used for living space.

At a minimum, installation of exterior drain tile or tubing at the footing and installation of an exterior water-resistant treatment of below-grade foundation walls are desirable and relatively inexpensive.

Remedies for Basement Moisture Problems

With increasing construction, purchase, and selling costs, more homeowners are seeking additional living area by finishing their basements. Based upon national data, it appears that each year 45.000 Minnesota homeowners are spending about $80 million on basement finishing. This trend, coupled with growing attention to foundation insulation, has increased the need to correct moisture problems in existing basements.

Correcting moisture problems in your basement involves essentially the same principles and actions as preventing such problems in new construction (e.g., site and soil analysis by an engineer or soil scientist to determine the source and type of moisture problem; foundation assessment by an independent building inspector, consulting engineer, or foundation contractor to determine the relative condition of the concrete, masonry, and mortar; assessment of comparative cost-effectiveness of different waterproofing systems; and selection of the acceptable method of application or installation according to manufacturers' documents.

Since the cost, difficulty, and often the degree of minimum applicator skill are greater in corrective procedures, the homeowner should exercise rigorous care in selecting a waterproofing contractor. Beware of a salesperson who:

- claims you have a water table or soil problem, especially if independent soil borings and analysis have not been completed;
- claims his or her system is uniquely "blessed" to solve any moisture problem in any type of foundation;
- claims you will receive a discount if you buy right now without obtaining other opinions or verifying his or her claims;
- implies your foundation is subject to imminent collapse unless you install his or her system very soon; or
- fails to observe and inform you of conditions that may contribute to your moisture problems that may not be corrected by his or her system (e.g., interior condensation, site drainage, and downspout and gutter defects).

You can sometimes resolve your basement moisture problem with do-it-yourself, band-aid remedies (e.g., correcting surface drainage, repairing cracks, applying an interior waterproofing compound, using a dehumidifier). If you do not have the time, interest, or energy to experiment with band-aid options, on-site observations by independent experts should precede selection of a system and contractor.

Further Readings

Correcting Basement Moisture Problems (Special Report 2), Agricultural Extension Service, University of Minnesota, St. Paul, MN 55108, 1981. $1.05.

"Basement Waterproofers: Your Best Buy . . . ," *Rodale's New Shelter,* April 1981: 38-48.

"Basement Waterproofing Paints," *Consumer Reports*, July 1974: 512-514.

Effects of Substances on Concrete and Guide to Protective Treatments (IS001.04T). Portland Cement Association, 5420 Old Orchard Road, Skokie, IL 60077, 1980. $2.75 + $1.00 shipping.

Repairing Damp or Leaky Basements in Homes (IS129T). Portland Cement Association, 5420 Old Orchard Road, Skokie, IL 60077, 1981. $.75 + $1.00 shipping.

Waterproofing Considerations and Materials (ESS FS 04). Underground Space Center, University of Minnesota, Minneapolis, MN 55455, 1981. $1.50.

Water Coatings for Concrete Masonry (NCMA TEK 55). National Concrete Masonry Association, 2302 Horse Pen Road, Hendon, VA. 22070, 1973. (Price unknown.)

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