Assessing, Repairing, and Rebuilding **Basements**

Controlling Moisture on Concrete Floors

Moisture on the surface of concrete floors is common in Iowa homes. It can cause numerous problems, including mold and mildew growth, wet rugs and carpet, damp and musty smells, rotting of wood, wet insulation, rusting of metal, and bacteria growth.

Water occurs on slab surfaces for a number of reasons, including:

- condensation
- moisture migration through the slab from wet soil under the slab
- broken or leaking pipes buried below or in the concrete
- surface water from leaks or flooding collecting on the concrete

To reduce the moisture problems in the basement, the flow of moisture into the concrete from outside must be stopped. All leaks must be fixed.

You may have to combine several of the following measures to control moisture in your home. Controlling moisture during new construction is inexpensive and effective. But in an existing house, controlling moisture often is expensive, involves compromises, and may not be effective. Obtain competent advice *before* deciding what to do.

Provide Good External Drainage

Good external drainage consists of surface measures to remove water from the surface of the ground and sub-surface measures to remove water from below the surface. Surface measures include sloping the soil away from the house and equipping the house with roof gutters. Subsurface measures include placing 4 to 6 inches of uniformly graded washed rock or gravel under the basement floor, providing a drain outlet, and draining tile lines to a free outlet. In most Iowa locations subsurface drainage will be needed.

For more information, see *Proper Drainage Around Your Home*, Pm-1560, available at your local Iowa State University Extension office.

Provide a Moisture Barrier

To reduce moisture migration through concrete floors, place an impermeable water barrier over the rock and gravel before placing the concrete. Polyethylene film is low cost and easily installed, but it is easily punctured and difficult to seal at the edges. More durable products are polyethylene-coated kraft paper and glass-reinforced waterproof paper, extrusion coated on both sides with polyethylene. Use 8 mil or heavier material and do not puncture the barrier.

Use Control Joints

Use control joints, construction joints, and isolation joints, and fill them with a suitable caulk. Joints are needed where the floor abuts walls or columns, around floor and shower drains, around plumbing openings, around electrical conduits, and around all other floor penetrations.

Use High Quality Concrete

Use a low-water concrete mixture in basement construction. Excess water decreases the strength of the finished concrete, causes it to shrink excessively as it dries, and leaves voids as the excess water evaporates. Weak concrete cracks more easily, shrinkage leaves cracks that moisture can penetrate, and voids allow water to seep. Use only the amount of water needed for curing. Drier concrete requires more labor to place and finish. Make certain the labor is available before starting work, so the laborers will not be tempted to add excess water at the job-site, and then puncture the water barrier to allow the concrete to "dry."

Use air-entrained concrete with a 28-day minimum compressive strength of 3,000 psi, a maximum slump of 5 inches, and a minimum cement content of 520 pounds per cubic yard unless experience demonstrates that less cement may be used to produce acceptable concrete.

Concrete curing for both walls and floors is an important step in producing durable, long wearing moisture-resistant concrete. Concrete is cured by applying water to the surface or by retaining water within the slab. Curing should be started as soon as possible without damaging the surface. It should continue for 5 days in warm weather or 7 days in cooler weather. Do not allow the concrete temperature to fall below 50° F during curing.

Use Insulating Concrete

Insulating, or lightweight, concrete is made with insulating aggregate. It has warmer surfaces, which reduce the amount of condensation. Check with your architect, engineer, designer, contractor, or concrete supplier for additional information.

Insulate the Floor

To insulate concrete slabs, place insulation around the perimeter walls. Use extruded polystyrene insulation, rigid fiberglass, or urethane foam. You can insulate crawl spaces and slabs with exterior insulation on the walls or footings. The insulation must be continuous and connect with the insulated walls above.

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Most of the heat loss occurs at the perimeter of a structure, and no additional insulation is needed under the floor slab to save energy. However, a small amount of insulation (R-3) under the floor slab can help reduce summer condensation.

Carpet the Floor

Basement carpet furnishes both a moisture retarder and some insulation. The room and the top surface of the carpet will be slightly warmer after the carpeting is installed, which can reduce surface condensation on the carpet.

Because carpet retards the flow of heat and moisture, moisture can easily be trapped between it and the concrete and require longer to dry than on a floor without carpeting. Keep carpeted rooms dry and warm. Never install carpeting over floors that leak or have moisture migrating through them. Do not carpet wet areas.

Insulate Above the Concrete, Construct Another Floor

In existing homes, interior measures may be the only alternative. Insulating above the concrete and constructing another floor above the insulation may be a solution to cold, wet floors with moisture condensing on the surface.

However, a wood floor system and insulation above the concrete can trap moisture and cause problems with mold, mildew, wood rot, and odor. If water does enter the home through the concrete or by flooding, the subfloor and insulation usually must be replaced. Exterior moisture drainage and exterior insulation are preferred options.

Table 1. Insulating a Concrete Floor

1. Seal the concrete floor surface.
2. Attach preservative-treated (nominal) 2-inch x 2-inch (actually 11/2 x 11/2) wood sleepers 24 inches on center to the concrete floor.
3. Place 11/2 inch closed cell extruded polystyrene rigid insulation between sleepers.
4. Cover the floor with a 4 or 6 mil vapor retarder.
5. Screw plywood flooring to the wood sleepers.
6. Cover the plywood with flooring.

If headroom permits, use thicker wood sleepers and 2 or 3 inches of insulation.

The concrete floor must not leak or be wet from anything except condensation. If exterior water leaks or seeps onto the floor, drainage must be provided before insulating. Typically, a concrete floor is insulated as shown in table 1.

Control Winter Moisture

Excess winter humidity levels in homes can be caused by moisture evaporating from the floor slab surface, even when the concrete appears dry. For more information, see *Controlling Winter Moisture Problems in Houses*, Pm-947, available at your local Iowa State University Extension office.

Seal the Concrete Surface

Commercial products can seal concrete against small amounts of capillary moisture migrating through the slab. Another option is to place a 6 mil vapor retarder on the floor, and place a new 2-inch slab on the existing slab. Consult with your architect, engineer, contractor, or concrete supplier about this option and the concrete mix needed. This option will not reduce condensation, nor stop moisture from entering when the water table rises above the floor level.

Eliminate Water Leaks

Check for broken water pipes in and below the slab, and in walls. A small leak can discharge hundreds of gallons of water over time. Check for roof, appliance, and other leaks.

Dehumidify the Area

Dehumidifiers remove moisture from the air, and heat the air in the space. Warm air can hold more moisture. Removing the moisture and heating the space helps reduce condensation problems, but may make the basement uncomfortably warm. Dehumidifiers usually will reduce summer condensation problems. Check with appliance suppliers for the proper size dehumidifier for your space.

Air conditioners remove moisture as they cool the air. Since the basement already is cool, the short operation times needed to keep it cool may not be sufficient to remove moisture. Cooler air cannot hold as much moisture, which condenses on cool surfaces. Air conditioner supply ducts in a concrete slab cool the slab and increase the risk of condensation on the slab surface.

Operating both a dehumidifier and air conditioner will remove moisture and keep the space comfortable, but at a higher energy cost.

Open Spaces and Circulate Air

You can open spaces by leaving doors open and putting louvered doors on closets. Circulate air with the heating and air conditioning blower, ceiling fans, or small circulating fans. Place furniture on small blocks and away from walls so air can circulate.

Ventilate the Basement

Ventilating basements to reduce condensation requires a constant watch on weather and temperatures. On hot dry days, outdoor air circulated into the basement will help dry the basement and heat the walls, reducing moisture.

On hot humid days, outdoor air might condense on the concrete depending on the temperature and moisture levels. If the amount of moisture on the walls increases after you open windows and ventilate, close the windows and operate a dehumidifier and/or air conditioner to reduce moisture levels.

Ventilating on cool dry days can cool the concrete, increasing surface condensation when the air temperature and humidity rise. Ventilate cautiously. Do not ventilate on cool wet days.

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