What's Happening to My New House?



Council Note A1.7

Architecture



College of Fine and Applied Arts University of Illinois at Urbana-ChamThis circular will help explain why walls in new houses get cracks, why nails show through the drywall, and why other unexpected problems happen.

The information contained in this publication was produced by the School of Architecture—Building Research Council (BRC) at the University of Illinois at Urbana-Champaign. For a set of 27 Council Notes for \$29.95 call 1-800-336-0616.

Lumber loses about ten per cent of its moisture content by the end of the first or second heating season.

Loss of moisture from lumber after the first or second heating season causes the lumber to shrink an average of 3/8" but possibly as much as 3/4". Many owners of new homes are horrified to see cracks forming in their newly-decorated walls and ugly nail heads poking through the carefully finished drywall. There may even be a crack appearing between the wall and the ceiling in the hallway. Their new home looks as though it is falling apart before their startled eyes. Should they angrily call their builder? Or perhaps their lawyer? Probably neither. Let us look at the situation in detail.

SHRINKAGE CRACKS

When "dry" lumber is first purchased from the lumber dealer, by Federal standard it has an average moisture content of 19%. After lumber in the house has gone through one or two heating seasons, the average moisture content may drop to 9%. In the process of losing 10%



of its weight in water, the wood shrinks. A typical floor joist is a 2 x 10, which is 9-1/4" high at the time of installation at 19% moisture content. After it dries to 9% moisture, it may shrink to about 8-7/8" high. The entire house may settle 3/8". However, when the floor joist is support-



ed at one end on the concrete foundation and the other end on a center girder made up of three 2 x10s nailed together, the girder also shrinks 3/8". Therefore, the entire house settles toward the center during the first winter. In the process, diagonal cracks often appear in the drywall at the corners of doors in the inside walls.

One of the reasons the builder gives





a one-year warranty with the house is so that these cracks caused by the



lumber shrinkage can be repaired after the heating season. In some cases, the center girder will have to be raised slightly and reshimmed on the tops of the girder supports to make the

door openings in the cross partitions square again and to close the cracks. This lumber shrinkage is not the builder's fault, and there is nothing that can be done about it except make the repairs at the end of the heating season. Likewise it is useless to make the repairs as the cracks appear, since the lumber may not be through shrinking yet. Wait until the end of the heating season.

NAIL POPS

Lumber shrinkage may also cause nail pops, where the head of a drywall nail or screw pushes the finishing compound loose and "pops" out of the wall. In this case, the point of the nail stays exactly where it was driven into the wood, but the wood shrinks, leaving a small space between the drywall and the face of the



framing member. If any pressure is applied to the wall finish, the drywall slides down the shank of the nail, causing the nail head to protrude, and pop off the finishing compound. The solution is to use a punch to drive the nail deeper, then apply new finishing compound, sand, and repaint. Nail popping will appear most often near the corner of a wall or ceiling.

TRUSS RISE

Another problem, which is somewhat related, is that of truss rise. Most roof framing is composed of trusses, which are complete triangular frames that extend from wall to wall. In an effort to control energy costs, insulation is used to cover the ceiling, and it is usually deep enough to completely cover the bottom member of the truss. Since it is buried in insulation, the bottom member is warmer than the upper members during the winter, so it dries more, causing it to shrink. Because of the geometry of the truss, the bottom member is pulled upward, lifting the ceiling off the interior partitions, particularly near the center wall. During the summer, it will usually return to its original position.

In most cases, this truss rise happens only once, the first winter. However, in about one case in five, it happens each year. If the problem happens just once, repair of the drywall tape at the joint between the wall and the ceiling is all that is required. If the problem reappears, the only practical solution is to use a molding to cover the joint. The molding is fastened only to the ceiling and moves up and down on the wall, covering the crack. The problem is not structural, and indicates the presence of extra-heavy insulation in the ceiling. This problem is likewise beyond the control of the builder, but he should be responsible for repair of the joint after the first heating season and for installing the molding if that is necessary.



CONDENSATION BETWEEN WINDOW PANES

If the house has double-glazed windows with removable interior storm panels, there may be condensation between the prime window and the storm panel. This is caused by the outside window being tighter than the inside panel. Many such windows have two or four weep holes through the frame between the panes to eliminate this problem. They look like eyelets in the frame and they should be cleaned out with a pipe cleaner or wire each fall. Some newer windows have slits in the side of the window as shown below. The holes are small, and there is a species of tiny spider that loves to make their nest in them.



Keep slits for ventilation clean. Photo by Scott Spies

MOISTURE CONDENSATION IN THE NEW HOUSE

At the beginning of the first cold weather in the fall, the new homeowners are likely to be greeted with moisture condensing on the windows and running down onto the sash and sill. The paint finish at the bottom of the window may begin to peel. The humidity is too high. What can they do? Ventilate!

It may seem odd to open a window in cold weather when you have paid a premium for a well-insulated, tight house, but it is necessary. The building materials are drying and the moisture has to go somewhere. The lumber is losing about 10% of its total weight in water. There is excess moisture in the concrete work and in the interior finish materials. particularly plaster and drywall taping compounds. The building materials may release as much as a ton of water during that first heating season, and additional ventilation may be needed to dissipate the moisture. If your house is equipped with a ventilation system or air-to-air heat exchanger, make sure it is running. It may be necessary to open a window a crack or run a kitchen or bathroom exhaust fan most of the first winter to remove the excess humidity. A moisture problem during the first winter may well be a temporary one.

Building Research Council

Backfill can settle and cause water to collect and seep through basement walls.





Rain

WET BASEMENTS AND CRAWL SPACES

Another possible cause of moisture problems is a wet basement or crawl space. A crawl space MUST have a plastic ground cover installed over the soil surface to control moisture evaporation. Standing water in the crawl space, especially above the plastic, is a matter for serious concern. Water under the plastic is a minor problem. Even with no standing water, a damp crawl space can release large quantities of water.

Settling of the backfill around the foundation during or after construction may have directed water from the yard or roof against the foundation, causing flooding of the basement or crawl space. Liquid water should be pumped out, and the necessary regrading done. If there is a continuing problem with water in the crawl space, it may be necessary to install a perimeter tile leading to a sump and a pump to drain it. The plastic should extend over the tile and sump.



Downspouts should have extenders to carry water at least 5 feet away from houses with basements and 3 feet for houses with crawl spaces.

Water runs away from the foundation when the ground is sloped away from the house under the landscaping gravel.



What's Happening to My New House?



When leaves block a gutter, it's worse than having no gutter at all. The water overflows at one point instead of all along the roof edge.



A break in the clay drain tile directs all of the water from the downspout against the foundation.



Here the rain drips directly off the roof to a plastic-lined gravel bed with tile for runoff.

GUTTERS AND DOWNSPOUTS

Water in the basement or crawl space? It probably came from the roof! Improper disposal of the roof runoff is the most prevalent cause of water problems in the house.

If the house is not equipped with gutters and downspouts, the force of the water dripping from the roof edge onto the ground will dig a shallow ditch at the drip line. This ditch will keep the water near the house, where it can soak down and through the foundation. If the house cannot be equipped with gutters, it is essential that the ground slope away from the house on all sides, and that the surface of the soil be protected from erosion by some form of landscaping. Landscaping rock works well for this purpose, as long as the homeowner remembers that as far as drainage is concerned, the gravel is not there. The drainage slope must be maintained beneath the gravel. Gravel in a trench around the house merely forms a moat, with the roof water to fill it.

Installing gutters is only the first step in roof water control. The discharge from the downspouts must be directed away from the foundation, preferably at least five feet away. While downspout extensions are a nuisance when mowing the lawn, they are essential to keeping the basement or crawl space dry. The downspouts may discharge below grade to a storm drain, or on sloped sites, to daylight. If the basement is wet near the drain tile, the connections should be checked.

Maintenance of gutters is necessary, too. A sagging or blocked gutter is worse than none at all, because it overflows in one place rather than all along the roof edge, and at a point that is not prepared for the overflow. In areas with many mature trees, where gutter blockage by leaves is common, perhaps it is best to leave the gutters off and allow the roof runoff to drip into a plastic-lined gravel bed a foot or so deep, with a perforated drain tile in the bottom to carry the water away.



GRADING AND DRAINAGE

Many houses experience problems with water or moisture problems in the crawl space or basement. Most of these problems are the result of improper grading around the house. According to many of the building codes, the bottom of wood, metal, or vinyl siding should be

The bottom of the wood, metal, or vinyl siding should be at least eight inches above the soil level around the house.

On a brick veneer house, the soil level should be at least six inches below the sill plate.





at least eight inches above the soil level around the house. In the case of brick veneer, the dirt should be at least six inches below the sill plate of the floor framing. This distance is necessary to avoid damage to the siding, sill, and joists from water splashing up from the soil or landscaping material. Even though the interior floor framing is protected by brick veneer, enough moisture will penetrate the brick to cause rotting of the sill and floor joists if the ground level is above the sill plate. Unfortunately, few builders set their houses that high above grade, primarily for the sake of appearance.

A second requirement is that there should be a slope of about six inches away from the house in the first ten feet. When this slope is present and the grading level is as specified above, water and moisture problems are rare.

The owner of a new house should be aware that even if the builder does the grading properly, some settlement will occur during the first and second years of occupancy. It may well be necessary to add another truckload of dirt around the house to compensate for the settlement of the backfill around the foundation. This is often ignored, because the proud owner has installed landscaping that will have to be revised or replanted when the soil is added to maintain the original slope. Many homes more than 50 years old still have a "moat" around them because the settlement of the backfill was never refilled. That is probably the second most prevalent cause of wet basements in older houses.



There should be a slope of about six inches in the first ten feet away from the house.

BALANCING THE HEATING AND COOLING SYSTEM

An important part of good performance of any comfort conditioning system is balancing the system so the distribution of heated or cooled air is proportional to the loss or gain of each room. The balancing may be done best by the home owner. The system could be balanced by a contractor, but the cost could be excessive, and the adjustments are partially based on the family's perception of comfort. A correct balancing adjustment cannot be done in one day. A typical balancing sequence for the heating season is as follows:

- Step 1. All dampers, both in the duct system and at register and grille faces, should be opened. (See drawing below.) If you do not know the location of dampers in the duct system, ask.
- Step 2. Adjust the room thermostat to a comfortable temperature.
- Step 3. Leave six or more desk-type thermometers at table height in various rooms. They need not be expensive or even accurate, as long as they all read the same when they are in the same location. Observe them once or twice a day during typical winter weather.

- Step 4. Partially close the dampers, preferably in the duct system that supply those rooms that tend to be too warm. Usually these will be small rooms and rooms near the furnace. If there are rooms that still do not get warm enough, partially close the dampers to all the other rooms until the cool rooms reach the desired temperature.
- Step 5. When the system is balanced to the temperatures you like (not necessarily all rooms at the same temperature), the damper settings should be marked.

The procedure will need to be repeated during the cooling season, with the dampers being partially closed to rooms that overcool until the warmest room cools to the desired temperature. The damper settings for the cooling season will be considerably different than for the heating season. When the desired distribution is reached, mark the summer setting.

After the correct winter and summer settings are marked, the dampers can be reset easily as the seasons change. If there are rooms which cannot be heated or cooled satisfactorily, it may be necessary to add another duct and outlet (or a duct booster fan), but that is rare.

(Closed Position Open Position



Mark all positions of damper levers for both heating and cooling seasons.

© 2005 by The Board of Trustees of the University of Illinois

Material in this publication by: Henry R. Spies

Editor: BRC Staff

Graphic Arts: Selah D. Peterson Drawings: Selah D. Peterson



All rights reserved. No part of this publication may be reproduced in any form without permission in writing from the publisher. Published by the Building Research Council, (BRC)- School of Architecture, College of Fine and Applied Arts, University of Illinois at Urbana-Champaign, One East Saint Mary's Road, Champaign, Illinois 61820. This publication is one of a series written for the homeowner. Write us for a complete list of publications, or call (800) 336-0616. Check out our Web site at http://brc.arch.uiuc.edu.

Open all dampers to start balancing the air flow in your heating and cooling system.