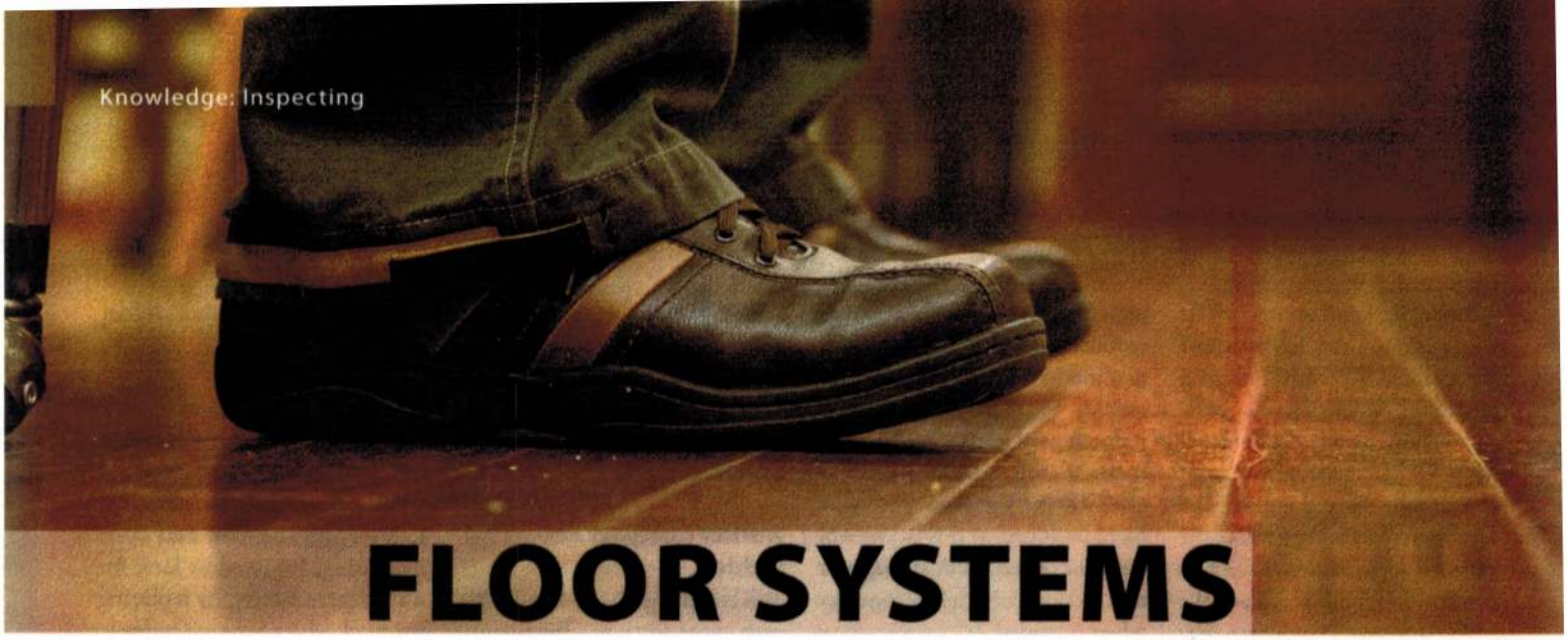


FLOOR SYSTEMS

From ASHI@HOME by Carson Dunlop

Most suspended floors are wooden and most floors resting on the earth are concrete slabs. While there are other systems, we'll restrict our discussion to these.

Function

Floors transfer both live and dead loads to the foundations, footings and, ultimately, to the soil below the house. Floor systems also provide lateral support for foundation walls. In houses with basements, the concrete basement floor provides lateral support for the bottom of the foundation wall and the wood-frame first floor typically supports the top of the foundation wall.

Vertical and horizontal loads

Floor systems see both vertical and horizontal loads, although most people think of the vertical loads when they think of floors.

To perform their functions, floors must have strength and stiffness. Contrary to common understanding, strength refers to how much load can be applied before something breaks. Stiffness refers to how much bending or deflection takes place with a given load.

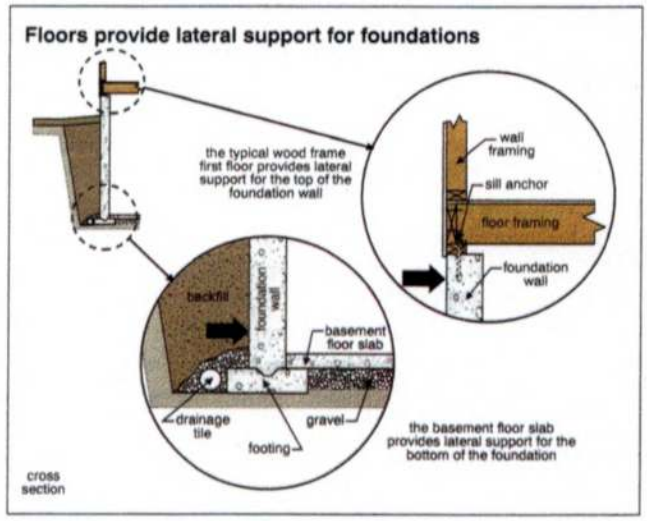
Strength

Floor systems must be strong enough to carry their loads. If the loads are excessive, the wood or concrete will break and the floors will collapse.

Stiffness

Floors also have to be stiff. This means that they have to limit the deflection that takes place when structural members respond to live loads. There always will be some deflection, but if the deflection is too great, damage to the interior finish will result. In some jurisdictions, the maximum allowable deflection is 1/360th of the length of the joist. This number is not magic, but comes from the amount of deflection that plaster and drywall will tolerate without cracking. Check what numbers are used in your area.

Generally speaking, floors with ceilings below use this limiting factor. In some cases, the allowed deflection is either 1/360th of the length or ½ inch, whichever is less.



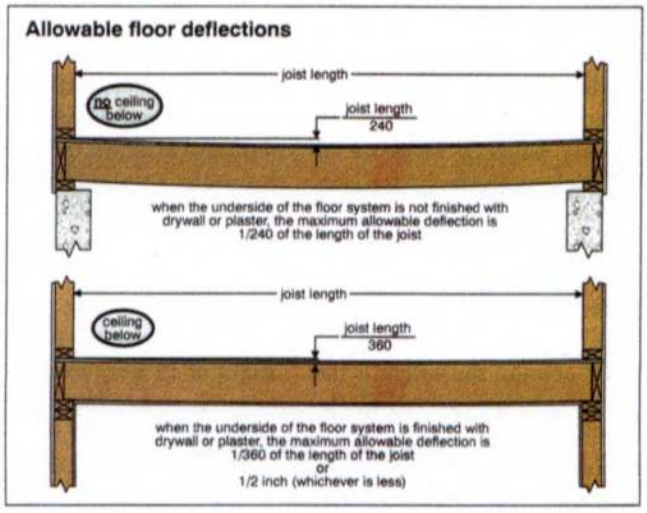


PHOTO AT TOP® JOSHUA BLAKE

1/240th Of Length

Where a plaster or drywall ceiling will not be attached on the underside (for example, the floor over a crawl space), the maximum deflection may be allowed to be 1/240th of the length.

Limited by bending

Floor systems in houses are designed with maximum bending, not strength, as the restricting factor. As a result, floors usually are much stronger than they need to be. It's rare for floor systems to fail catastrophically unless they have been severely damaged by rot, insects or careless carpentry work.

Large loads transferred through center of house

Many think that the perimeter foundation walls have a large vertical load to carry because they are below the outside walls. A typical house with wood siding and a central bearing beam actually has a greater percentage of its weight on the beams and posts than it does on the outside walls. That's because the foundation wall only sees floor loads from one side of the wall (the inside, of course). A beam running down the middle of the house sees floor loads from both sides.

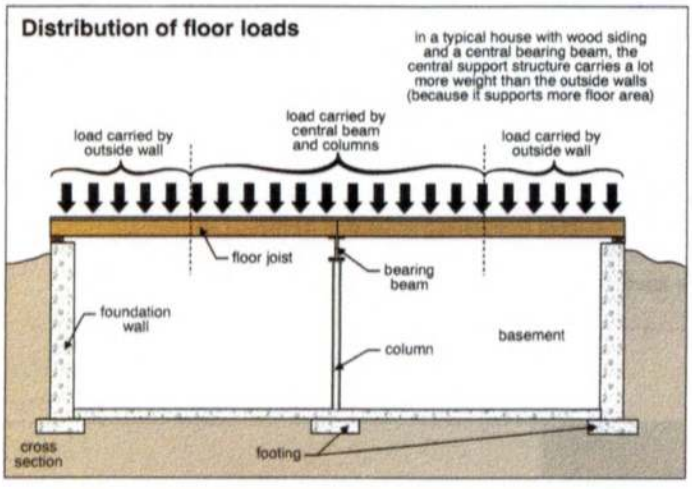
Many people skimp on footings, columns and beams since they mistakenly assume the loads will be lighter for these interior members. Good design of beams and columns or interior bearing walls is critical to avoid sloping floors. The amount of settlement through the middle section of the house should be similar to that around the perimeter. If the settlement is greater or less in either area, floors will be uneven.

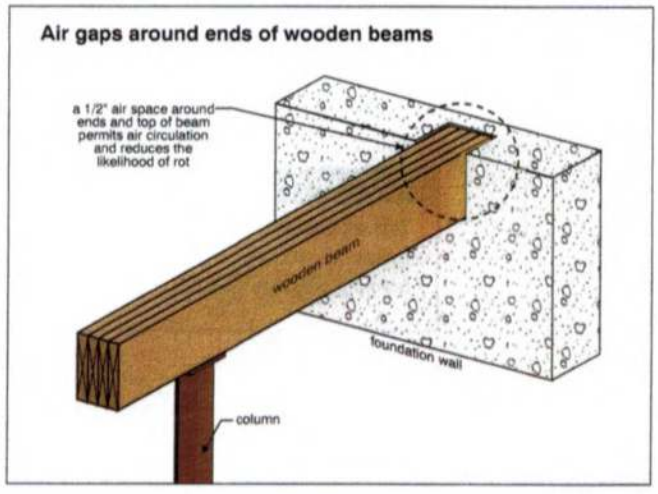
Avoid wood/concrete contact

In areas at or below grade, the best practice is to avoid direct contact of wood with concrete. Polyethylene separators or sill gaskets can be used. Alternatively, the wood can be pressure-treated. We want to avoid moisture in the concrete being wicked into the wood, causing rot. This applies to beams, columns, joists and sills.

Joist/beam pockets

Where beams or joists go into pockets in foundation walls, it's common to keep the sides, top and ends of the wood ½ inch away from the concrete to allow air circulation and keep the wood dry. Where the wood has to be embedded, it should be pressure-treated and/or field-treated with a wood preservative to prevent rot. ▸▸





In this photo, the homeowner incorrectly added a post and beam to support additional live loads

This photo shows a support beam that is inadequately supported and does not have adequate air gaps.

Nailing

Appropriate nailing is required to achieve a solid structure. Carpentry books or building codes tell you:

1. how long nails should be,
2. how many should be used, and
3. what type should be used for any given connection.

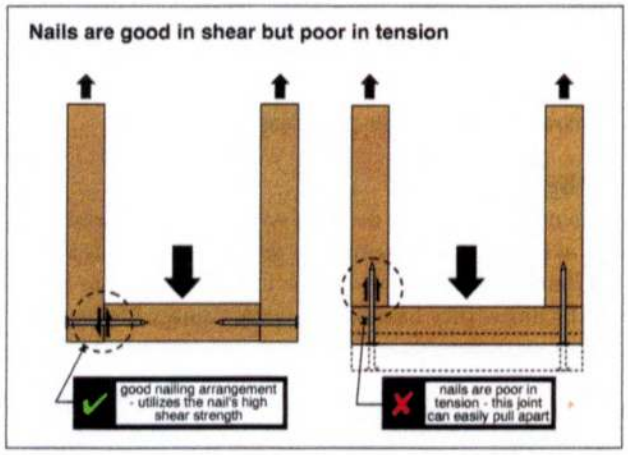
We'll mention a few good nailing practices, although most nailing is not visible to the home inspector.

Good practice

1. Each nail should have half its length go through into the second piece of material.
2. Nails should not split the wood that they are driven through, and must be kept away from edges to avoid this.
3. When several nails are driven in along the length of a piece of wood, it's good practice to stagger the nails so the nails don't split the wood along a single grain line.

Good in shear, but lousy in tension

Nails hold well when the forces are pushing the nailed pieces together or trying to make one piece slide against the other. Nails are not good in tension, where the forces want to pull the wood apart. This tends to pull the nails straight out.



Components

These are the five components of a wood flooring system:

- Sills
- Columns
- Beams
- Joists
- Subflooring

Defects for these five components and their associated causes, implications and strategies for inspection, are discussed in detail in the ASHI@Home training program. ■

ABOUT ASHI@HOME

This article is from the ASHI@Home education system, developed by Carson Dunlop with ASHI. Individual modules are approved for ASHI CE credits. *Choose the printed version or the online learning program.* **Call 800-268-7070, Ext. 251, to learn more.**

More About Floors?

If you finish reading an article in the *Reporter* wanting more, we have a suggestion. Visit **www.ashireporter.org**, click on search, enter the topic and see what comes up.

FOR EXAMPLE, when we did that for floors and flooring systems, here's what we found.

In August 2003, JD Grewell wrote **"Structural Considerations of Floor Framing and Load Distribution."** He covered tracing the loads from the roof to the ground, the basics of framing and more with illustrations provided courtesy of "Code Check Building" by the Taunton Press.

In that same issue, he explained his findings regarding a squeaky floor in **"For Want of a Squash Block."**

A creaky floor also was the topic of Jim Rooney's article **"Creaky Floors and Other Issues that Bug Homeowners"** in the September 2006 issue.

If you'd like to know more about flooring materials, specifically wood, read the January 2007 article by Don Lovering: **"Walk the Plank."**

And these searches can turn up some unexpected gems. "Inspecting Wood Trusses" does not discuss floors; nevertheless, we bet you find this article by Garet Denise in the July 2007 issue worth a read.

Take advantage of what ASHI members have shared over the past 12 years. It's only an online search away.