Photo: Chris Ulster

Ten Common Code Violations

Pay close attention to these to avoid failing inspections

BY CHARLES WARDELL

About 45% of residential field inspections result in a code violation. That's according to the Common Code Violations survey released in 2013 by the International Code Council (ICC) and the National Association of Homebuilders (NAHB). Researchers polled code officials across the U.S. about the items most likely to be flagged during construction.

The survey found overall compliance improving. Although inspectors are flagging a few specific items—most notably foundation anchor bolts, guardrails, and stairs—more often than in the past, in general they reported far fewer failed inspections than in a similar survey published in 2006.

Competitive pressures have certainly contributed to that improvement; failed inspections and re-do's cost time and money. But state-mandated contractor training has also played a role. "The educational requirements for licensing have helped a lot," Vaughn Wicker, ICC's vice president of government relations, said. "A lot of states now require training to get or keep a license, so builders in general have better code knowledge than in the past."

But even though things are getting better, 45% is still a big number, leaving plenty of room for improvement. With that in mind, *JLC* looked at published lists of the top code violations from various municipalities across the country and contacted building inspectors to find out what items have been giving builders the most trouble. Our findings confirmed those of the ICC and NAHB researchers.

Here is a list of the most common reasons that a builder or remodeler will fail inspection. Paying extra attention to them should make for fewer items that need correction.

MISSING DOCUMENTATION

The most common reason a builder fails an inspection is the simplest (and least expensive) to remedy: not having all the required documents on site. This was at the top of nearly every municipal list we looked at and cited by every code official we contacted.

"The first thing I look for is the documentation," Glenn Mathewson, a Westminster, Colo. building official and a regular *JLC* contributor, said. "If I show up and they don't have the plans I need for that inspection, then there's no hope of passing." In his city, that includes an engineer's foundation letter, the structural plans, the truss drawings, the plan for the HVAC ductwork and gas piping, and the energy code documentations. These documents will, of course, vary by jurisdiction, but it's up to the builder to know what they are and to have them available.

Darryl Byle, a former building inspector and structural engineer from Kalispell, Mont., said that his city came up with a quick fix for the problem: The building department decided to put a stop work order on any project where the drawings weren't on site. "That got the drawings on site pretty fast," he said.

IMPROPERLY PLACED ANCHOR BOLTS

When it comes to footings and foundations, we expected the biggest offense to be improper rebar placement. We were wrong.

Although some inspectors mentioned rebar, the error everyone cited was surprising: missing or improperly placed foundation anchor bolts. The ICC study also listed this as one of the violations that's become more widespread, though it's not clear why.

A common mistake Byle sees is bolt locations that don't work with the mudsill joints. "You need a bolt on each side of every joint on the sill," he said (see "Anchor Bolt Placement," right). "But a lot of concrete guys just put bolts every 6 feet, rather than asking the framer where the joints will be." The problem could obviously be avoided by better coordination between the framing crews and the concrete crews. Mathewson pointed out that anchor bolts are a lot harder to fix than some other problems, so it's worth the effort to get them right the first time.

It's worth noting, too, that the 2015 IRC now requires the anchor bolts to be placed in the middle third of the width of a foundation plate. This complicates bolt placement even further. For a 2x4 plate, that means you've only got about 1 3/16 inches of tolerance to get it in the right spot.

BRACED WALL ERRORS

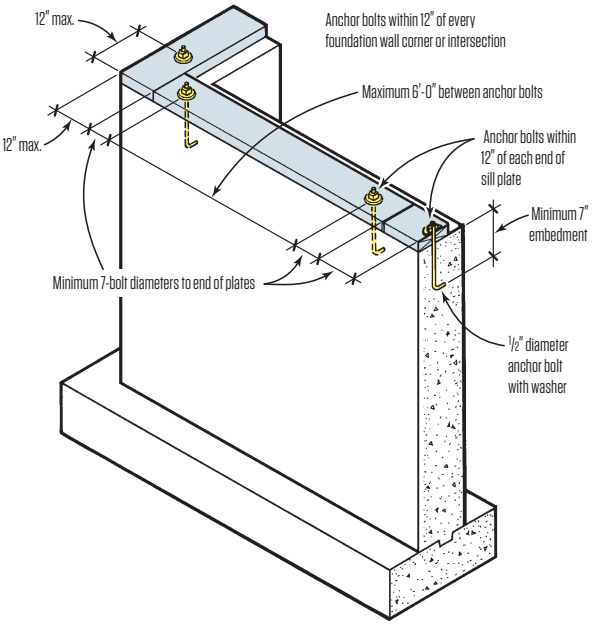
Code-mandated braced-wall requirements can be a head-scratcher for someone encountering them for the first time. "The requirements are new to a lot of builders and a lot of them are still climbing the learning curve," Shapiro said. (See "Bracing Walls for Wind," Jul/13.) But even when the bracing requirements are spelled out clearly on the plans, it's the little details that often escape framers. The most common oversight Shapiro finds is missing blocking for braced wall panels. Code requires nailing along all panel edges, and that may require blocking between studs on tall walls or when panels are run horizontally. Fortunately, blocking is usually easy to add.

The problem Mathewson sees most often—overdriven nails in bracing panels—can take a bit more work to correct. "If you overdrive a nail, you can reduce the strength of a 7/16-inch panel to that of a 3/8-inch or 1/4-inch panel," he said. (As an aside, he pointed out that this is a problem with nailing off hangers as well. Overdriving a nail dimples the steel, causing it to lose strength.)

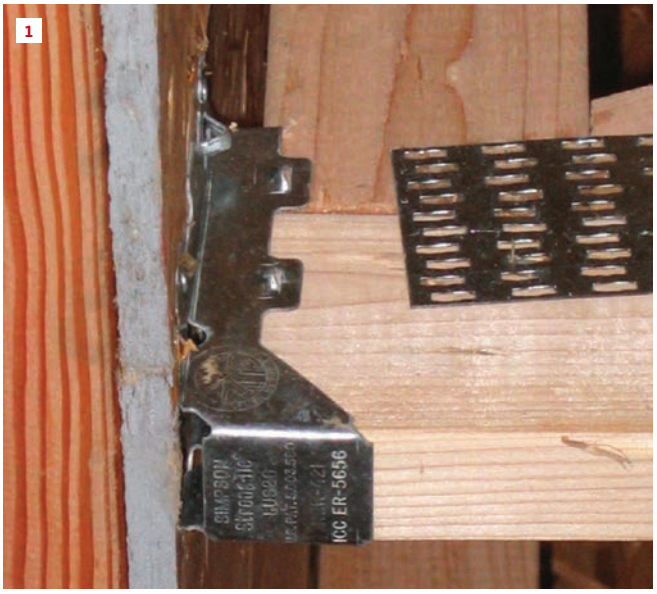
WEAKENED JOISTS AND BEAMS

Inspectors see a lot of beams that aren't sized for the load or that lack proper bearing. This is more common in remodels than in new construction. It often comes up when a contractor cuts through an exterior wall to add a sliding door or removes an interior bearing wall to create a more open living space. "If it's a load-bearing wall, they often think they can just open it up and throw in a double 2x8," Mathewson said. "But you need to do a structural analysis to

Anchor Bolt Placement



Given the anchor-bolt requirements (these conform to the 2012 IRC), it's often easier to use epoxy anchors. J-bolts require coordination between framing and concrete crews.



The gap at the end of the floor truss is a tell-tale sign of a framing violation. Any truss or joist must have full bearing on the hanger seat. This hanger may be undersized, as well, for the size floor truss it supports.

Racking resistance is a structural key to a deck that will resist failure over time. This photo shows an effective way to brace deck posts. Running the diagonals in both directions provides much-needed racking resistance.

determine how much load the beam will need to support, especially if there are floors above." He also pointed out that newer homes have more complicated load paths. "You really need to pay attention before you start poking holes in the structure."

One of the biggest problems Mathewson sees is gaps at the ends of joists or trusses supported by hangers **(1)**. It doesn't take much: Gaps can be caused by a girder truss that's slightly crooked or out of plumb, making the time required to use a string line and level well spent.

Manufacturers of structural hangers usually specify a maximum gap of ⅛ inch between the end of the joist and the girder. Anything bigger will put moment arm on the hanger and drastically reduce its load capacity. When hangers are double-shear nailed (toenailed), large gaps leave the nails completely missing the carried member. "People get upset over this because they think I'm being punitive," he said. "It's not me, it's the manufacturer's load requirements."

DECK LEDGERS AND BRACES

Byle isn't far from Polson, Mont., where a 2004 deck collapse at a casino injured 52 people after the connection between the deck and the building failed. The culprits included hangers that were too small for the joists, improper fastening, and inadequate flashing that set the ledger up for rot.

Despite more attention paid to decks, including the requirement in some jurisdictions for lateral connectors, he and other inspectors still see lots of issues with deck connections. On retrofits, he often recommends that the contractor build a freestanding deck with the deck frame an inch or so away from the house and the structure independently supported on posts . This eliminates the difficulty of properly flashing and fastening the ledger to the house.

He also finds builders falling down on deck shear-bracing requirements. Typically, diagonal post bracing is required **(2)**. To further resist racking, builders can also use flat-framed 2-bys run diagonally on the underside of the joists . "Racking is a source of failure over time. If the deck isn't properly braced, fasteners will work loose," Byle said. He added that it doesn't take much: "Something as simple as kids running around and banging into rails can put stress on the fasteners."

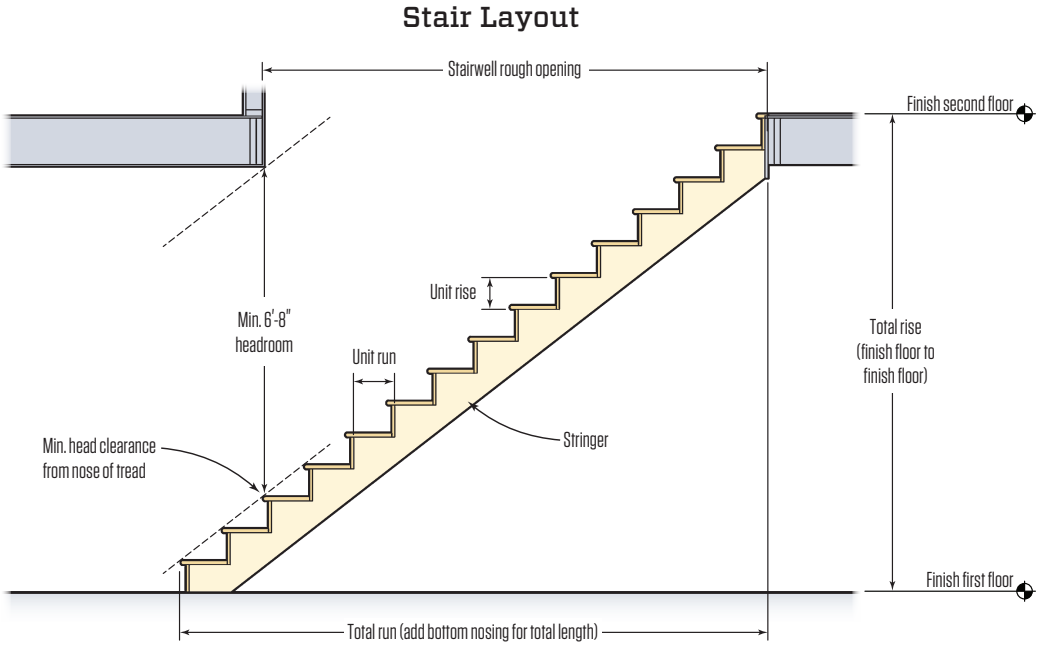
STAIR RISE/RUN ERRORS

Rise/run problems can arise where the builder doesn't have enough horizontal space for a planned stairway. Headroom is a limiting factor (see "Stair Layout," facing page), and Byle has seen a lot of builders try to squeeze the stairs in by simply pitching the stairway a little more steeply, resulting in a rise that may be too high or treads that are too narrow.

Another common problem Byle sees is that builders, who may get the correct riser heights and tread depths, often don't adjust for the added thickness of the flooring at the bottom. That leaves them with a bottom step that doesn't match the rest of the stairway.

In Hampton, Va., building official Steve Shapiro finds a lot of rise/

Photos: 1, Jim Mattison; 2, Jim Findlay



Headroom is often the limiting factor for a given stair opening. Building codes require a minimum 6 feet, 8 inches from the tread to the ceiling. Shortening the stairs only works if you can maintain tread and riser requirements. The steepest residential stairs allowed by code has 7 3/4-inch risers and 10-inch treads.

run errors on stairs leading up to porches from sidewalks. "I get the impression that people start at one end and work their way up or down," he said. "Then they end up with a top or bottom riser that's too short." Some builders may assume that the inspector will overlook this on an exterior stair, but Shapiro pointed out that the riser and tread requirements apply equally to the interior and exterior of a home.

Keep in mind that liability associated with stairs goes beyond inspection failure. Byle, who also works as an expert witness, said that stairs come up again and again in construction litigation cases: "If the stair isn't dimensioned correctly and someone falls, the jury is going to side against the contractor regardless of whether the stair actually caused the fall."

STAIR HANDRAILS AND GUARDRAILS

In some cases, stair handrails and guardrails are the wrong height as measured from the tread. By code, they must be a minimum of 34 inches, and no more than 38 inches high. In other cases, the connection to the stair isn't secure enough. The latter problem is often because the builder has skimped in the blocking needed to make a secure connection.

Another common oversight is at the return at the top and bottom of a handrail. The rail can't just end, but has to die back into the wall or post, or terminate in a manner the code calls a safety terminal. Otherwise, the end of the railing could catch on things like pants pockets or purse straps, causing a fall. The terminal requirement is relatively new to residential construction but has long been a feature in commercial buildings, where it's meant to protect firefighters in stairwells. "There were cases where a firefighter was running up a stairway with a hose and the hose got caught on the end of a handrail, pulling the firefighter down," Mathewson said.

Fortunately, stair manufacturers now make a variety of volutes and other termination pieces that make this requirement a lot easier to meet than in the past.

MISSING OR INADEQUATE FIRE BLOCKING

Fire blocking must be installed at code-mandated locations in concealed cavities (see "Typical Fireblocking Locations," next page). The blocking prevents these cavities from acting as draft chimneys, thus slowing the spread of flame and smoke during a fire. This delay buys the occupants time to get out of the house.

Fire blocking must cut off the concealed draft openings between

all vertical and horizontal cavities, essentially compartmentalizing the areas from each other. And because they're often obscured by complex elements such as soffits, they're not always obvious, making it easy for the framer to miss spots that need to be blocked. "In my field inspections, I find that a lot of people fall down on this," said Aaron Johnson, a Palm Beach County, Fla., fire inspector who runs a website called TheCodeCoach.com. He added that builders who understand what areas need to be blocked often use the wrong materials. "One of the most common mistakes I see is not using the proper [fire-rated] caulking," he said.

Of course as a fire inspector, Johnson would naturally look for blocking problems, but everyone else also cited it as one of the top reasons for inspection failure. "A day doesn't go by when I don't see a home with this issue," Mathewson said.

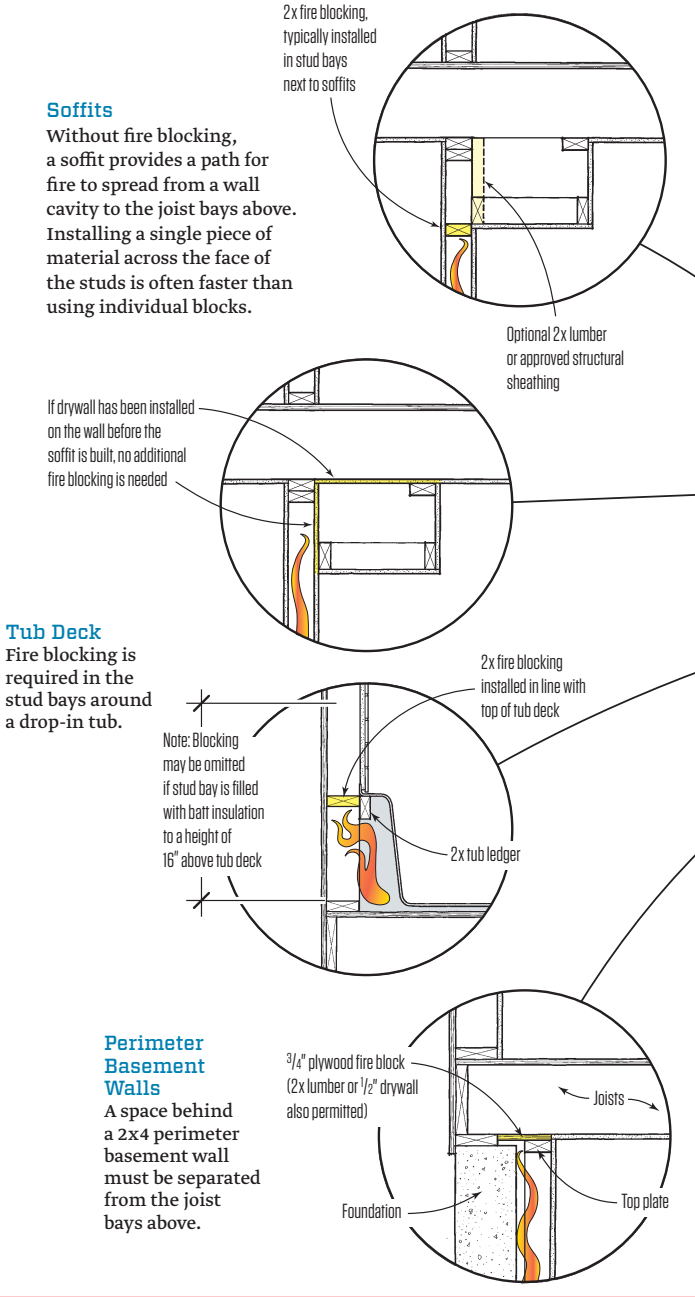
Often, a builder will use the right material but use it incorrectly, according to Mathewson. For instance, some foam sealants are rated for use as fire blocking, but can only be installed up to a maximum thickness, which they're often not. He also sees many cases where builders try to get away with 7⁄16-inch OSB as fire blocking, rather than the 23⁄32 inch required by code. They usually have to add a second layer.

AIR-BARRIER GAPS

With more jurisdictions adopting energy codes, air-barrier gaps have become an issue. As is the case with fire blocking, these are often in hidden spots, such as behind bump-outs for gas fireplaces. "In the old days, the fireplace was just a hole in the wall," Mathewson said. "Now you have to wrap the thermal envelope around the back of it."

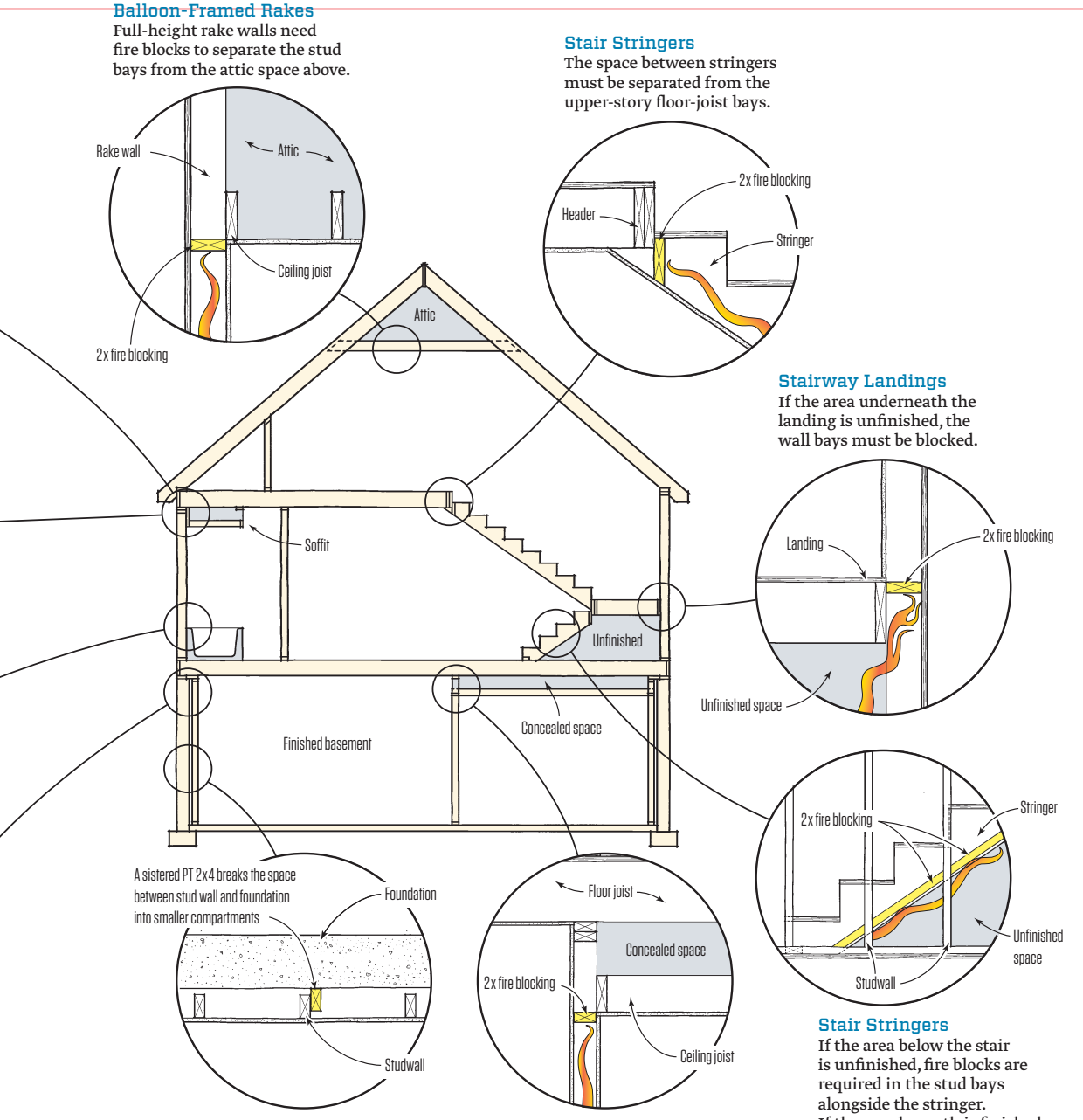
While IRC Section R302.11 does describe a few specific locations for fire blocking, to address all the required locations, it's key you understand the intent and purpose of fireblocking: "to cut off all concealed draft openings ... and to form an effective fire barrier between stories, and between a top story and the roof space."

Typical Fire-Blocking Locations



Balloon-Framed Rakes
Full-height rake walls need fire blocks to separate the stud bays from the attic space above.

Stair Stringers
The space between stringers must be separated from the upper-story floor-joist bays.



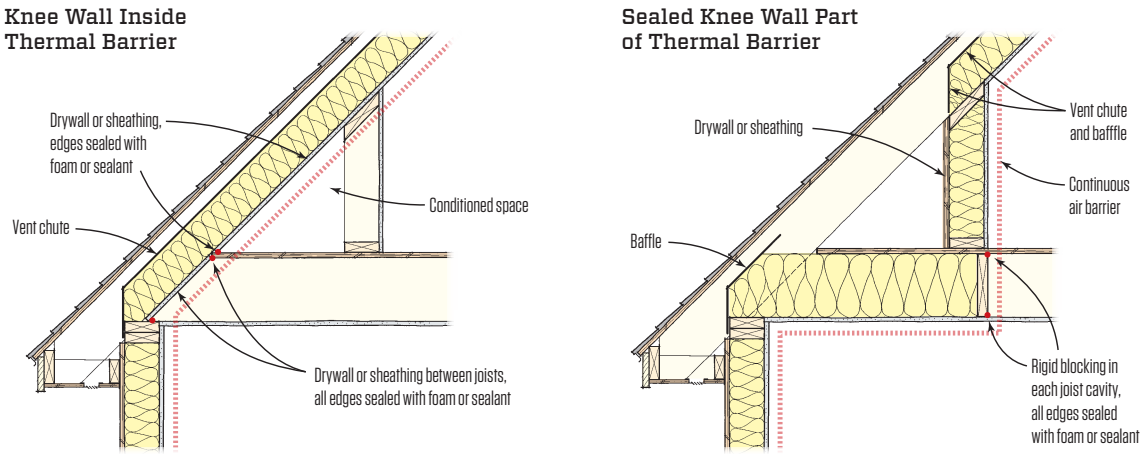
Stairway Landings
If the area underneath the landing is unfinished, the wall bays must be blocked.

Stair Stringers
If the area below the stair is unfinished, fire blocks are required in the stud bays alongside the stringer.
If the area beneath is finished with minimum 1/2" drywall, this blocking is typically not required.

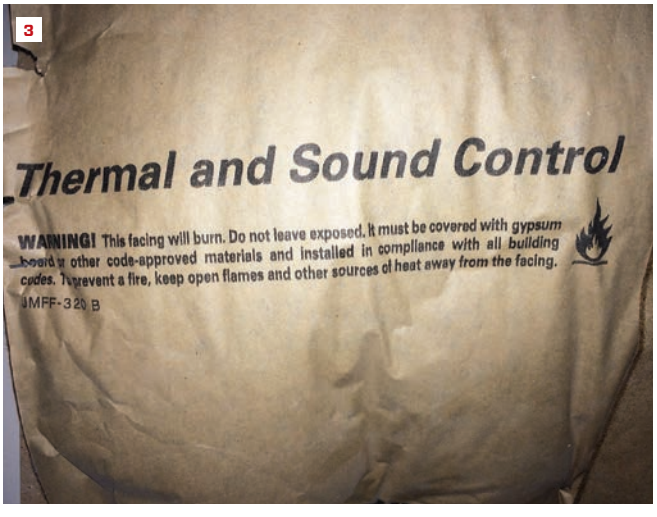
Concealed Spaces in Walls
When a wall is not drywalled or sheathed on both sides (which is typical of furred-out basement walls and double stud walls) there must be a full-height fire block every 10 feet horizontally.

Dropped Ceilings
Dropped ceilings can be blocked in the same way as soffits.

Air-Sealing Knee Walls



Air-sealing needs to be part of the framing stage; it's not something that can be done as an afterthought. Knee walls are one of the framing locations where it's often done wrong. The best way to handle them is to move the thermal barrier to the roofline and stand up the knee walls after the ceiling has been drywalled. For production builders who may have less control in scheduling trade partners, the knee wall can serve as the thermal barrier, as long as sheathing is installed on the back side.



The warning label on paper-faced insulation batts clearly states: "This facing will burn ..." It cannot be left exposed but must be covered with drywall or other type of sheathing permitted by code. This applies in concealed framing cavities, in knee-wall areas (even if the knee-wall area is inaccessible) in attics, and in crawlspaces.

He also sees a lot of missing air barriers behind HVAC chases and attic knee walls. On a knee wall, this can be corrected by putting a rigid material like drywall, OSB, or Thermo-Ply on the back of the wall (see "Air-Sealing Knee Walls," above), but a lot of framers aren't doing it.

EXPOSED KRAFT-FACED INSULATION

Speaking of knee walls, the backing is more than an air barrier; it's also needed to cover kraft-faced insulation batts. These are often left exposed in knee-wall areas and in basements.

Big mistake. "You can't leave the paper exposed," Mathewson said. In fact you can't even leave a gap between it and the wall covering. "The paper is coated with a bituminous material and is highly flammable," he said. "You don't want airflow over the surface that could feed a fire." The label printed on the insulation clearly states that the facing will burn and that it must be contact with the wall or ceiling covering **(3)**.

That brings us back to the point we made at the beginning of this article: A lot of failed inspections could be avoided if builders actually read the manufacturers' instructions and the documentation provided with the building permit. The time saved by not doing so can cost a lot more time later. As Mathewson put it: "It's a lot easier to fix errors with a pencil than with a Sawzall or a sledgehammer."

Charles Wardell is a contributing editor to JLC.

Photo: Glenn Mathewson

TOP CODE VIOLATIONS

The Common Code Violations Survey, published by NAHB and ICC in 2013, asked building officials nationwide to rank violations in 16 different categories. The responses were too many to include here, so we have listed the top three in each category. They're in descending order, with the most common violation at the top. Use this as a checklist when preparing for an inspection or, better yet, download the report to see the full list for each category.

Grading and Site Drainage
- Erosion control measures not in place
- Grading
- Downspouts/ drainage controls

Foundation
- Improper reinforcement or support of rebar
- Standing water/mud in footing or on rebar
- Improper anchor bolts

Wall Framing
- Missing fire-blocking
- Stud cut or notched to an impermissible depth
- Missing hold-downs, straps, etc.

Floor Framing
- Notches in areas not permitted
- Missing anchor bolts
- Sheathing nails missing joist

Trusses
- Bracing not installed
- Improperly connected to wall plate
- Impermissible alteration leading to additional load

Roofing
- Missing nails or fasteners
- Over-driving of nails through shingles
- Absence of felt, or incorrect type

Window and Door
- Improper flashing
- Inadequate fire rating
- Improper door weather-stripping

Handrail
- Improper height or spacing
- Improper graspable surface
- Missing handrails

Guardrail
- Guardrail opening too large
- Height criteria not met
- Not properly fastened or installed

Stair
- Stair rise and run violations
- Stair headroom
- Improper stair construction

Plumbing
- Improper notching or boring of framing
- Missing or improper nail plates
- Pipes improperly supported

Mechanical
- Inadequate combustion air or makeup air
- Improper notching or boring of framing
- Inadequate clearance to combustibles

Electrical
- Grounding issue
- Labeling of circuits
- GFCI Protection

Energy
- Improper sealing of penetrations through exterior walls
- Improper duct sealing
- Improper installation of insulation around wiring and plumbing passing through stud cavity

Decks
- Improper or inadequate ledger connection to house
- Improper guardrail or handrail installation
- Deck does not conform to approved plans

Life Safety
- Failure to install correct glazing in required hazardous locations
- Inadequate egress
- Improper installation of smoke detectors

Source: Common Code Violations Survey, Feb 2013.