



Code Ambiguities and Minimum Standards

The importance of code clarity and readership

By Nick Warndorf

Figure 1 – Picture of drip edge measured at eaves.

Building codes are routinely described as the minimum standards intended to hold builders accountable and protect the health, welfare, and safety of the public. But most individuals may not realize that state and local code enforcement departments are not directly funded by taxpayers. According to the website of the Metropolitan Government of Nashville and Davidson County in Tennessee (Nashville.gov), all costs necessary to fund and operate the codes department “are fully recovered each year through ‘user fees’ charged by the department as permit fees, license fees, plans review fees, appeal fees, and inspection fees.”¹ To put it another way, the folks who do business with the department—not the taxpayers—are footing the bill for its operation.

And unfortunately, most building inspectors have more projects than they can get to regularly, and many contractors are just as busy. In addition to too much work, both contractors and building inspectors struggle to find skilled workers on projects. On occasion, general contractors have admitted to not knowing every part of every applicable code on a project, believing that it was the code inspector’s responsibility to catch any mistakes.

Take the case of a moisture intrusion investigation. Often, an investigation involves code references because there is primarily *someone* rather than *something* responsible for causing the problem in the first place. A building enclosure consultant is called typically due to a mystery leak, for which no one seems able to locate the source, and that often reveals some form of negligence in standard building design

and construction practices. As part of their investigation, building enclosure consultants observe the existing conditions that lead to the issue, research building history, and write a report citing the believed or proven source of the leak. They then often make recommendations for correction of the main issue, all while citing any other potential problems uncovered along the way.

Meanwhile, from the very first contact with the client, the conversation is centered around who will be responsible for the damages and who will pay for the repairs. The conversation is often filled with recurring disbelief by the client that no one caught the issues from the start, and no one spoke up or corrected them. This disbelief is more common in residential buildings than commercial ones because the owners have a more personal connection to the outcome. Most property owners trust that both

contractors and building inspectors are working on their behalf and in the owners' best interests.

For building enclosure consultants, identifying and fixing problems is a good education in responsible building practices and the applicable codes. It teaches critical thinking through failure analysis and adds context to future planning and designs of building enclosures. That being said, even though building enclosure consultants have this specialized expertise, many in this line of work also believe that contractors and designers should also seek best practices that may require exceeding minimum standards, not simply meeting them.

As buildings become more complex, so does the implementation of good building science practices, which increases the possibility for design flaws. As a result, our understanding of the interactions among building components has evolved and is reflected in the publication of technical articles and building code requirements. These lessons, though, are useless if they are ignored or slow to be adopted. As an example, the state of Tennessee is due for an update of its building code.

According to the Building Codes Assistance Project website (bcapcodes.org) and the Tennessee State Fire Marshall's Office, the last codes adopted by the state took effect in August 2016, when the state adopted the 2012 editions of the *International Building Code* (IBC), the *International Residential Code* (IRC), and the *International Energy Conservation Code* (IECC).² These documents are, in my experience, the three most commonly applicable code standards in many moisture intrusion cases. Therefore, many of the references that follow will be to the 2012 versions of these codes.

COMMON CODE VIOLATIONS

Some of the most common code violations we have observed are related to asphalt shingle roof installations and exterior wall issues, including chimneys, doors, and windows. At least 80-90% of our consulting time is spent identifying and reporting these types of issues. This article is focused on drip edge and through-wall flashings.

Figure 2 – Picture of underlayment over drip edge.

Drip Edge

The currently adopted 2012 IRC section R905.2.8.5 says this about drip edges:

R905.2.8.5 Drip edge. A drip edge shall be provided at eaves and gables of shingle roofs. Adjacent pieces of drip edge shall be overlapped a minimum of 2 inches (51 mm). Drip edges shall extend a minimum of 0.25 inch (6.4 mm) below the roof sheathing and extend up the roof deck a minimum of 2 inches (51 mm). Drip edges shall be mechanically fastened to the roof deck at a maximum of 12 inches (305 mm) o.c. with fasteners as specified in Section R905.2.5. Underlayment shall be installed over the drip edge along eaves and under the drip edge on gables. Unless specified differently by the shingle manufacturer, shingles are permitted to be flush with the drip edge.

Within this one installation requirement, there are potentially a myriad of issues. Drip edges are commonly installed:

- with staples rather than nails,
- over the underlayment at eaves, rather than under it, and
- rarely extending up the roof deck by at least 2-in

All of these common installation practices do not follow the provisions of the 2012 code. Most of the problems that occur related to drip edges are likely the result of commercial production standards. Metal fabrication produced in bulk saves con-

tractors time and energy in customizing the metal work to the project as shown here in *Figure 1*. This is an image of a mass-produced drip edge found in most commercial supply houses with standard sizing.

In 2012 IRC section R905.2.8.5, we can see a standard, commercially produced drip edge that is less than the minimum-required 2-in. installation, primarily because the fabrication style or angle holds the drip edge off the fascia, preventing a 2-in. extension. Going further, the manufacturer of the drip edge must take the measurement from the end of the drip edge outside lip to achieve a full 2-in. measurement, which is about ¼-½ in. from direct contact with the eave.

The drip edge itself is almost always affected by the existing framing. There are often gaps between the roof sheathing and fascia that the drip edge must span in order to have a solid fastening surface. Lastly, if the specifications call for an ice and water shield at the eaves (common in steep-slope roof systems), there is no way to verify that the drip edge was installed with nails (not staples) after the underlayment is installed, nor whether it has been done correctly (*Figure 2*).

All of these conditions may be avoided with the simple inclusion or specification of a specially fabricated (not commercial) drip edge. It would also be helpful for manufacturers to start producing drip edges with a greater span that extended up the roof deck, over any gaps, and provide plenty of fastening surface. Also, virtually all shingle roofing crews should eliminate staple guns from their tool bags for roofing applications.



Edge detail on lower roof - drip edge covered by underlayment



Figure 3 – Picture of failed through-wall membrane without through-wall metal.



Figure 4 – Through-wall flashing.

Instead, they should switch to pneumatic nail guns that use cap nails if they wish to be both efficient and effective. The cost of one of these nail guns is far less than the cost of repeat site visits to correct edge metal details.

Drip edges have been part of codes in residential roofing in the state of Tennessee for a long time; however, investigators frequently find that newly installed roofing systems do not have them. This is mainly the result of poor site supervision and quality control, lack of knowledge of the installer with regard to codes, or simply (albeit infrequently) the result of gross negligence by workers. Whatever the case may be, the inclusion of proper edge metal details can significantly extend the longevity of fascia board and gutter fastening, and prevent ice damming and potential leaks at the eaves of the roofing system.

Through-Wall Flashings

Through-wall flashings can be regarded as an integral part of an overarching concept that extends to chimneys, masonry walls, doors, and windows, among other applications. The general concept is that through-wall flashings provide redundancy in the event that the outermost material of the building enclosure fails at some point. Providing a watertight design incorporating through-wall flashing that extends through the wall and up the sheathing behind it (to be counter flashed by the existing weather-resistant barrier) can help prevent moisture-related issues. This is because any moisture that is present will find its way back out again at the lowest

possible point of the wall without jeopardizing the prevention of moisture intrusion in other forms, such as from snow drift and ponding or flooding of roof systems.

Through-wall flashings are commonly investigated in residential consulting work, and yet they are still rarely understood by many repair crews and new construction project managers. We have worked with many masons over the years who have never incorporated copper through-wall flashing into their masonry installation—either because the plans didn't call for it or because the specification was for peel-and-stick WRB membrane in lieu of copper or stainless steel. The benefit of the latter specification is cost in both material and labor, but it is likely to cause much more costly problems later. Most chimney rebuilds start around the \$20,000 to \$30,000 mark, and that's assuming that there won't be any framing work as part of the scope. In these types of projects, the full extent of the damage is rarely known until you start taking things apart. *Figure 3* is an example of improper through-wall flashing using membrane rather than metal, which is just short of the brick exterior thereby defeating the design intent. *Figure 4* shows through-wall flashing that has an opening for drainage as intended, and *Figure 5*

Although many understand the direct costs of building failures (including increased consulting fees), there are more indirect costs due to building flaws than most people realize. These indirect costs relate to the public health and safety aspects of poor design and quality of work. An example of this comes from an FM Global study of international fires in the food industry, which followed two major fires in German meat processing facilities in 2016. The data gathered from 88 fires between 2010 and 2014 found that the cost of damages in facilities with well-designed and functioning sprinkler systems was €7.8 million less than that in buildings without. This means that the building without well-designed and functioning sprinkler systems had roughly 15 times greater the cost of damages.⁴

shows one of the most common conditions observed in single-ply membranes today, a termination bar over brick exterior (which is doomed to fail). *Figure 6* is a great example of the consequences of design and installation failure when proper attention to detail is not given.

With regard to flashing, section R903.2 under weather protection of the 2012 IRC says this:

R90.2 Flashing. *Flashings shall be installed in a manner that prevents moisture from entering the wall and roof through joints in copings, through moisture permeable materials and at intersections with parapet walls and other penetrations through the roof plane.*

With regard to through-wall flashings, the 2012 IBC says this:

1405.4 Flashing. *Flashings shall be installed in a manner so as to prevent moisture from entering the wall or to redirect it to the exterior. Flashing shall be installed at the perimeters of exterior door and window assemblies, penetrations, and terminations of exterior wall assemblies. Exterior wall intersections with roofs, chimneys, porches, decks, balconies and similar projections and at built-in gutters and similar locations where moisture could enter the wall. Flashing with projecting flanges shall*

be installed on both sides and the ends of copings, under sills and continuously above projecting trim.

This description is a start, but it remains problematic. Too often the membrane used in lieu of metal flashing is cut short of the edge of the brick line, which allows water that is intended to escape to unintentionally saturate the masonry. Also, membranes often do not feature end dams to prevent water from getting into the interior wall cavity at corners or intersections of multiple planes in confluence. Furthermore, we often find that membranes have “fish mouths” or excessive wrinkling resulting from improper installation. An argument can be made that similar errors can occur while soldering the tabs of copper through-wall flashings, but the installer generally understands the cost of bad soldering.

One of the best references to masonry assembly can be found in the Brick Industry Association’s (BIA’s) “Technical Notes on Brick Construction,” issue 7, from November of 2017, which has this to say about through-wall flashings:

Through-wall flashing is an impervious material installed in a masonry wall system to contain water that has penetrat-

ed the exterior wythe and direct it back to the exterior. Such flashing is required in a drainage wall system and is critical to the ability of the wall to manage moisture. In a barrier wall system, such flashing is recommended as a second line of defense to moisture intrusion. Proper design requires flashing at wall bases, windowsills, heads of openings, shelf angles, projections, recesses, bay windows, chimneys, tops of walls, and roofs. Sheet metal and flexible membranes are the materials most frequently used to create flashing. Flashing should extend vertically up the backing a minimum of 8 in. (203 mm) above the horizontal leg.³



Figure 5 – Improper wall termination.



Figure 6 – Picture of framing damage due to improper flashing.

By comparison to the code, which only allocates a few short paragraphs, this reference provides several pages and drawings detailing the application and purpose of through-wall flashings in multiple applications, including doors, windows, and chimneys. Properly designed and constructed flashings are important to building enclosure performance.

APPLYING WHAT WE'VE LEARNED

If the objective is to combat common failures and code violations, there has to be greater involvement by the industry and communication to the industry centered on the codes. Codes must become regarded as the guiding light rather than a source of fear. Furthermore, codes would be more applicable if they included more references to industry authorities such as IIBEC, NRCA, BIA, and others as a source of information and suggested further readings that are industry-specific. The average builder has a hard time navigating code requirements and would benefit from more training related to referenced AAMA and ASTM testing standards.

Video presentations and training are highly effective in communicating ideas with repeatable results. The industry would be greatly served by the inclusion of video links in code references. In order to reach a wider audience and help combat the mistakes of the past, it would be beneficial to incorporate video training as a standard practice in code writing. This approach, coupled with greater community involvement, is by far one of the best ways to approach training and development in the industry.

Greater community involvement and outreach is one of the most effective ways to encourage cooperation.

We recently hosted Steve Hawkins, a friend and former Deputy Commissioner of Labor with the state of Tennessee, to come and speak to our management and sales team about workplace safety. The goal

was to hear directly from an expert in the field regarding his approach to the problem of occupational safety. His philosophy was both surprising and refreshing because of its elegant simplicity. Instead of describing the financial cost and legal repercussions of non-compliance, he recounted instances in which workers had died or been seriously injured in the line of work and what the humanist side of that experience was like for him. He continued by saying, "I don't care if you follow the rules, but YOU should"—the message being that individuals are often responsible for the decision-making that leads to death and injury. The same can be said of code violations.

We have learned that many contractors want to be more efficient, effective, and proud of their work. That comes with knowledge and experience in this industry. Many contractors will never see or feel the effects of poor quality of work. The statute of limitations varies from state to state and proving quality of work failures is often a costly expense many want to avoid. Experiences like those detailed in this article leave an indelible mark on any observer, and they are cautionary examples of why we have minimum standards. We should all seek to exceed those minimum standards, and we need codes to consistently raise the bar of basic expectations and make those standards as widely understood as possible.



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NCARB/NOMA Study Find Architectural Field Lacks Diversity

The National Council of Architectural Registration Boards (NCARB) and the National Organization for Minority Architects (NOMA) partnered to collect data on equity in the process of becoming an architect. The study found that a person of color is 7% more likely to drop out of the path to licensure than a white person on the same path. The survey was sent to 70,000 recently licensed architects, licensure candidates, and people who stopped pursuing an architecture license, and received 5,000 responses. Barriers to completion of the process included financial concerns (the six-part Architect Registration Examination® alone costs a total of \$1,410, not including study materials), lack of diversity in leadership, and a lack of overall support.