

Why All Shingle Roofs Violate the Building Code (and Why It Typically Does Not Matter)

By Derek A. Hodgin, PE, RBEC, CCCA, F-IIBEC

BACKGROUND

Before getting too excited about the title of this article, please be advised that the objective is to identify and discuss one of the many abused technical building code issues that are being used in construction litigation claims by unqualified experts for the primary purpose of inflating the damages claim. While shingle attachment is discussed in some detail, this article is more about inappropriate expert behavior than shingle attachment.

Construction litigation is often a necessary step in the process to identify and correct defects that may compromise the durability or safety of a constructed building. There is typically at least one real problem that is identified by the owner that prompts a call to a construction expert and/or an attorney. However, since the owner may only get one opportunity to make a construction defect claim, there is incentive to perform a more comprehensive review of the completed building to identify any other construction deficiencies that may exist and require repair.

Oftentimes, the laundry list of deficiencies includes many issues that simply deviate from building code requirements but have no functional consequence for the overall performance of the building. These issues are added to cases simply to increase the value of a claim. While there are many examples of these deficiencies, this article focuses on one of the favorite issues identified by "experts" related to shingle attachment.

Shingle attachment is a favorite issue because, when compared to the idealized fastener placement diagram that has existed for decades in industry standards and shingle manufacturer instructions (referenced by the building code), *all* shingle roof installations will fall short. However, the author is not aware of any evidence to suggest that owners have ever performed repairs to specifically address these shortcomings, either during or after construction litigation.

PERFECTION IS NOT A CONSTRUCTION STANDARD

Figure 1 is based on a figure published in the Asphalt Roofing Manufacturers Association's *Residential Asphalt Roofing Manual*.¹ However, this figure (or language indicating fasteners should be "driven straight, flush, and snug to the surface of asphalt shingles") has been published by the National Roofing Contractors Association (NRCA)² and numerous shingle manufacturers³ for decades.

Clearly, Fig. 1 depicts idealized conditions that cannot be easily replicated in the field by human roofing contractors trying to install shingles in a reasonable amount of time. Additionally, this figure only shows the cross section of the shingle application. **Figure 2** from NRCA shows the physical location of where shingle nails are to be placed on the surface of the roof in "plan view" (see reference 4).

If either the nail orientation or location deviates from these figures, the unreasonable expert can technically identify a building code violation. Because the figures depict perfectly oriented roofing nails placed at specific locations with exact dimensions, no shingle roof will ever be installed to meet these requirements. To put this into perspective, in a 30-square residential roof [3,000 ft² (279 m²)], there would be approximately 65 to 80 shingles per square, and at least 4 fasteners per shingle, resulting in 7,800 to 9,600 roofing nails. Do we really expect all of the nails to be installed exactly (and perfectly)? Of course not.

Interface articles may cite trade, brand, or product names to specify or describe adequately materials, experimental procedures, and/or equipment. In no case does such identification imply recommendation or endorsement by the International Institute of Building Enclosure Consultants (IIBEC).

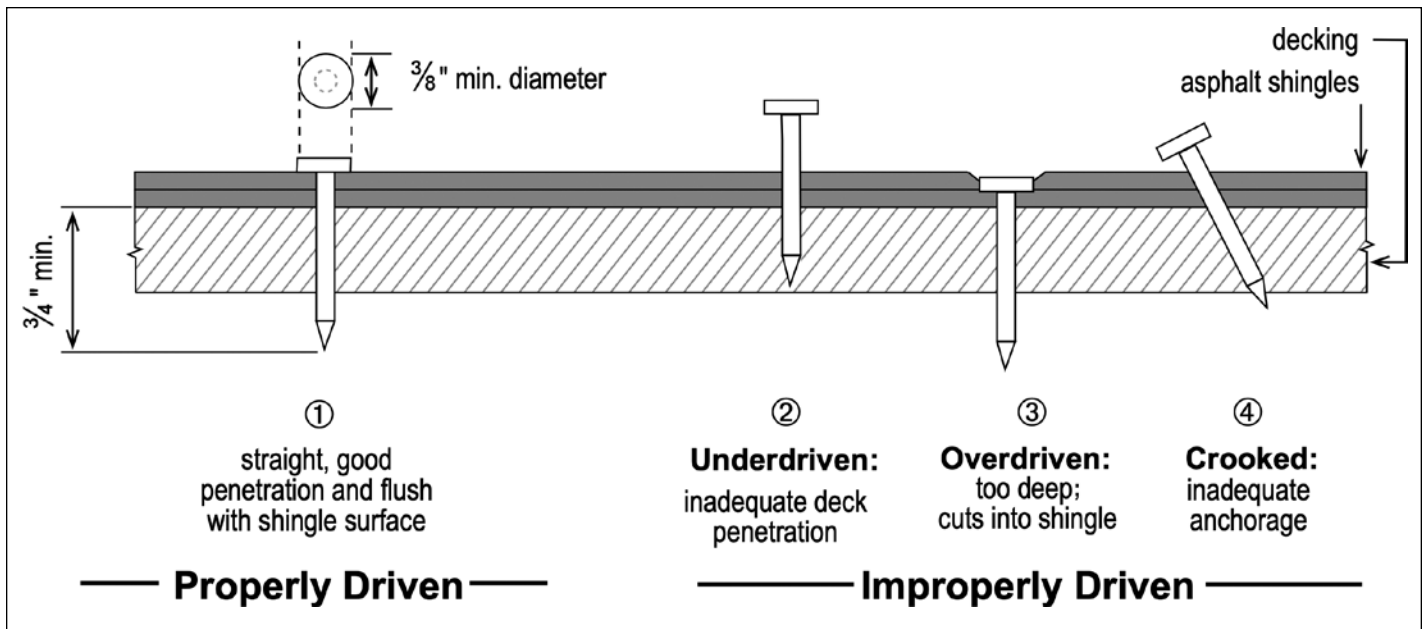


Figure 1. Application of nails.

Roofing contractors are not expected (and never have been expected) to measure the locations of shingle nails to match these figures. Rather, roofing contractors are expected to use these installation figures as a guide to fastener placement, understanding that deviations will exist. The author has confirmed this opinion with numerous shingle manufacturers over many years of dealing with this issue. Some shingle manufacturers have responded by creating nailing "zones" for contractors, allowing some forgiveness in the physical placement of fasteners.

DEFICIENT VERSUS DEFECTIVE

Fastener placements and orientations will deviate from the ideal conditions. However, depending on the severity of the deviation, the as-built condition may have little to no effect on the long-term performance of the shingle roof. These issues simply represent a deviation that may not require any repair at all. To address improper nailing, shingle manufacturers publish criteria that should be followed during the installation process. To put the terminology into context, consider the following definitions:⁵

Deficient: falling short, not up to a normal standard.

Defective: imperfect in form, structure, or function.

For a deficiency to become a defect, there needs to be functional damage and/or a consequence, such as compromised integrity and/or a measurable loss of expected service life. Functional damage is easily identified when improper nailing is extreme, such as

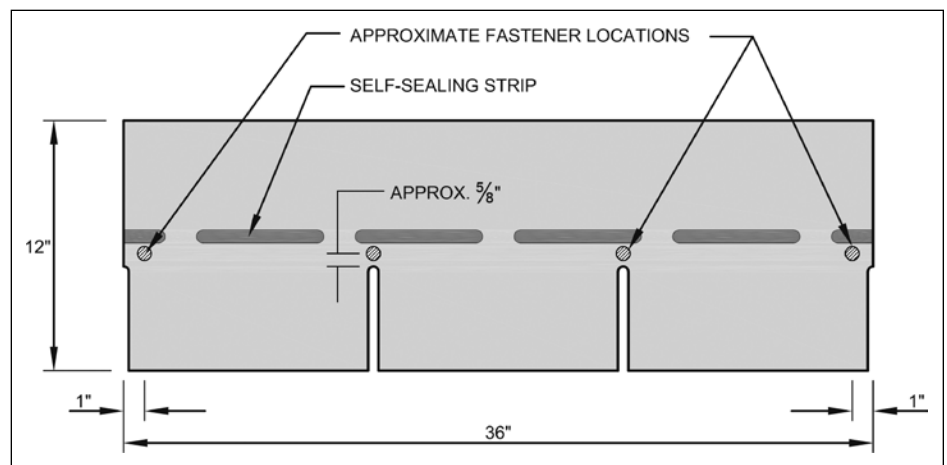


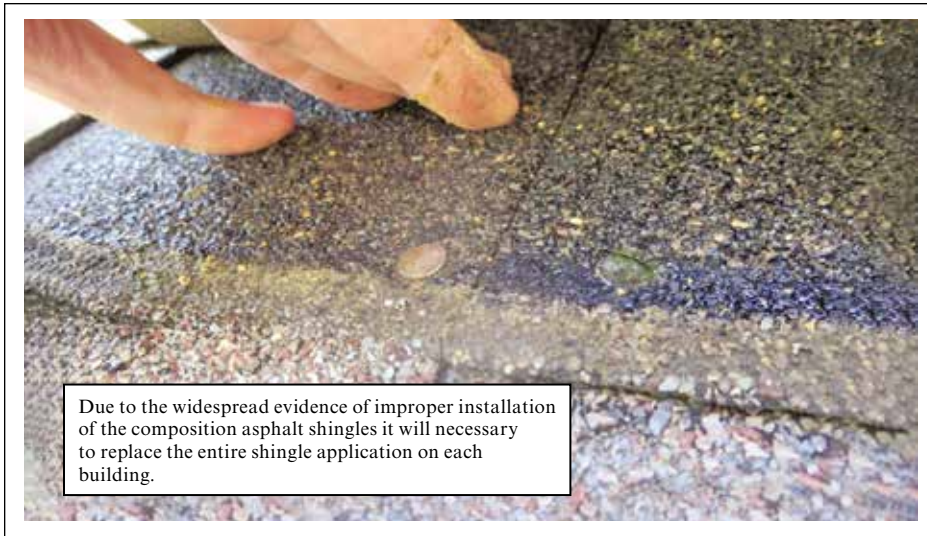
Figure 2. Location of nails.

nails overdriven completely through the shingle or a significant number of missing nails. However, minor deviations from perfection do not qualify as functional damage that requires repair.

It is ironic to think that in most cases, the so-called roof expert is causing more harm to the integrity of the shingles during the investigation process than the harm associated with the imperfect attachment that they are documenting. Specifically, most plaintiff experts will pry apart well-sealed shingles to observe the concealed fastener conditions below. After compromising the sealant strip and taking the necessary photographs, the author has observed some experts simply walk away with no attempt to reseal the previously uncompromised shingle assembly.

Clearly, these experts are unaware of the current state of the art in shingle manufacturing and the physics by which shingles are able to resist wind-related failure. Over the course of many years, shingle technology has evolved such that wind resistance has significantly improved, and most of it is related to the effectiveness of the manufacturer-installed sealant strip. By compromising the sealant strip during their investigation, the unknowing experts are likely impacting the wind resistance of the shingle roof much more than imperfect nails would.

For these reasons, the author will not pry apart well-sealed shingles to observe fastener conditions unless a roofing contractor is available to reseal the shingles using roofing cement in accordance with manufacturer's



Due to the widespread evidence of improper installation of the composition asphalt shingles it will necessary to replace the entire shingle application on each building.

Figure 3. Plaintiff report recommending roof replacement due to shingle attachment.

instructions or accepted industry standards. Alternatively, the well-sealed shingles are left in an undisturbed condition and a photograph of a hand attempting to lift a shingle is taken for reference. This is a reasonable option when the only evidence of shingle attachment issues is provided in a handful of photos from a plaintiff expert that depict only minor deviations.

UNREASONABLE “EXPERT” OPINIONS AND BEHAVIOR

Most “experts” who opine about shingle attachment lack sufficient education or training to even provide an opinion in the first place. If ever presented with a serious Daubert challenge by a well-informed attorney, these experts would likely be tossed out of court. This challenge requires “experts” to defend their opinions based on scientific, engineering, and/or technical merits. Because these “experts” do not contact shingle manufacturers to discuss opinions, do not perform any literature review of relevant work related to their opinions, and do not perform any testing or analysis to substantiate their opinion, they would likely fail this challenge.

A Daubert challenge is based on a US Supreme Court decision, *Daubert v. Merrell Dow Pharmaceuticals*, 509 U.S. 579 (1993), which requires that a judge determine whether an expert’s opinion has a valid foundation. Applied to this article, an expert might be able to appropriately opine that a shingle installation does not perfectly meet a manufacturer’s installation detail, but that expert may well not be qualified to testify that the shingle will fail in a specific high-wind event or that the useful life of the shingle has in fact been diminished.

Most so-called experts are simply comparing the always less-than-perfect as-built shingle

attachment conditions with the referenced figures shown above. The official expert opinion is that the as-built condition will “not perform as intended by the manufacturer and must be repaired”—after all, the constructed condition represents a building code violation! The only repair offered to address the imperfect shingle attachment is complete removal and replacement of the subject roof, as if the replacement shingle roof will somehow meet the unrealistic standards applied by the expert. **Figure 3**, and the included commentary below, are from an actual plaintiff report that alleges “widespread” improper shingle attachment and recommends complete removal and replacement of the subject roof.

To support the extreme recommendation of completely removing and replacing a less-than-perfect shingle roof, experts will sometimes present a questionable statistical summary of the handful of shingles that are observed during a typical investigation. The information summarized from the small data set can sound alarming to an unknowing audience, such as a jury. It is not uncommon to hear statistics such as 80% (or more) of the fasteners observed were improper (over- or underdriven and/or at the wrong location). Never mind that only dozens of fasteners were observed, out of the thousands that were installed on the subject roof. More importantly, the threshold used by the expert has *no tolerance* for imperfection, making most fasteners improper in some fashion. Unfortunately, the outcome of construction litigation is often based much more on perception than facts. All the jury has to hear is that most of the fasteners were installed improperly, and an inflated and unnecessary

monetary award will soon follow against the roofing contractor.

Recently, the author was provided the opportunity to observe a plaintiff expert testifying on the witness stand in a multimillion-dollar trial. The expert improperly became an advocate for his position and proceeded to plead with the jury, “These are people’s homes! These are building code violations that must be repaired!” The unknowing jury heard the words *building code violations* and likely believed this was a serious issue. Because we continue to allow unqualified “experts” to oversimplify roofing issues by applying unrealistic standards, insurance companies will continue to pay large sums of money to fund exaggerated claims of construction defects associated with shingle attachment. When the “expert” was asked if he contacted the shingle manufacturer to discuss his opinions, he indicated that was not necessary because he could read their instructions, unknowingly eliminating his “expert” status. In other words, if the entire opinion is based on reading the manufacturer instructions, the jury is fully capable of reading the same instructions without the assistance of an expert.

CAN A BUILDING CODE VIOLATION REALLY REPRESENT GROSS NEGLIGENCE?

There are some plaintiff attorneys, apparently with some support from previous court rulings, who suggest that a building code violation represents gross negligence. To review, to be grossly negligent generally means that you know what you are doing is wrong, but you do not care and proceed with the wrong act anyway. The author believes that shingle roofs are typically installed by contractors who care about their work, are familiar with shingle installation instructions, and make an effort to generally follow these instructions. How in the world do the less-than-perfect shingle installations rise to the level of gross negligence, even if the plaintiff attorney’s own roofing “experts” acknowledge that they have never observed a perfectly installed shingle roof? How can the acknowledged standard in the roofing industry represent gross negligence?

WHY DO ALL SHINGLE ROOFS VIOLATE THE BUILDING CODE?

The short answer to this question is that shingles are currently installed by human beings who are less than perfect. Additionally, most shingle roofs are installed using pneumatic nail guns

that are powered by air compressors. As the gun is rapidly discharged, the available air pressure is reduced, potentially resulting in an underdriven nail. When the air compressor is fully charged, the first nail shot from the gun has the potential of being overdriven.

The author has observed numerous shingle roof installations where shingle installers shoot all the nails into a shingle without moving across the shingle. The installers typically center themselves in front of the shingle and swing the gun from left to right, rapidly installing all the necessary fasteners in a matter of a couple of seconds. As the roofers swing the gun, the fasteners to their left and right (at each end of the shingle) are driven at an angle. If you lift enough shingles during the inspection process, you can often observe the arc pattern of the shingle nails corresponding to this installation technique, which clearly represents a violation of the manufacturer instructions, which are referenced by the building code.

To address this common installation deficiency, roofers simply need to move with the nail gun and only install fasteners that are located directly in front of them, resulting in the desired perpendicular orientation. As roofers move with the gun, the nails should be installed at a more even pace that allows the air pressure to remain relatively constant, reducing the potential for over- or underdriven nails. However, even when incorporating these better practices, perfection will not be obtained. An overzealous, uninformed plaintiff expert may still be able to find a technical code violation when perfection is the standard. Beware; even when you do a good job installing a shingle roof, there are experts who may claim your work is defective and the roof needs to be replaced.

These extreme positions are simply absurd and lack credibility. In fact, the author is of the opinion that it is actually the “expert” who has violated their own standard of care by being unethical when making unfounded claims, particularly if the expert is a professional engineer who is subject to ethical requirements to be objective and only provide written opinions within their area of expertise. For the record, being a licensed professional engineer does not make you an expert in roof shingles—in some cases, not even close!

DISCUSSION

It is important not to misunderstand or misrepresent what this article is saying. Of course, shingle attachment has a direct impact on the overall wind resistance and performance of a shingle roof assembly. That statement

is based on basic science and engineering principles. However, it is unreasonable to suggest that anything other than perfectly installed fasteners somehow causes the roof to be compromised sufficiently to require replacement. This article is as much, or more, about the inappropriate behavior of expert witnesses as it is about what constitutes proper shingle attachment. Keep in mind that the unreasonable expert position described is only possible because the *International Residential Code* (IRC)⁶ requires shingles to be installed in accordance with manufacturer instructions, and those instructions most often depict a very specific orientation and location for each fastener.

The oversimplified position that shingles must be installed in *exact* accordance with manufacturer instructions is lazy, lacks credibility, and requires no professional judgement. This article is not suggesting that shingle attachment is *never* a problem; it is simply suggesting that it is not *always* a problem. If an as-built shingle attachment condition is truly an issue that requires evaluation, perhaps consideration should be given to the total number of nails used per shingle, the head diameter of the nails used, the length of the nails, the physical locations of the nails, the type and thickness of the roof deck, the extent of truly over- and underdriven nails, the thickness and weight of the shingles, the rigidity of the shingles, the performance of the shingles when subjected to ASTM International tests, the test data used for the code evaluation report, the slope of the roof, and the design wind speed that the shingles are required to resist, among other relevant information.

The variables described above illustrate the need and purpose for a factor of safety. Because variability is expected in both the materials and workmanship in any constructed assembly, a factor of safety is used to reduce the risk of premature failure. In other words, neither the shingle manufacturers nor the building inspectors are expecting the installation of roof shingles (or any other building component) to be perfect. Manufacturers understand that their products are installed by humans and expect imperfection. Prescriptive building codes such as the IRC include built-in factors of safety. Claiming that minor deviations from specific code requirements will result in premature failure is unreasonable and lacks credibility. Unfortunately, those willing to make these claims will continue to be used by the attorneys who benefit from

them. As professional engineers and roofing consultants, we should recognize this pattern and refuse to be used for these purposes. As a side benefit, it is much more comfortable to testify when your opinions are based on facts that are supported by science, engineering, and industry research, rather than a rigid interpretation of one or two figures from shingle installation instructions.

RECOMMENDATIONS

To address issues of shingle nail placement, consideration should be given to establishing allowable tolerances (aka nailing zones) that can be adopted by the shingle roofing industry as a whole, rather than having only manufacturer-specific tolerances. This would provide at least some forgiveness for less-than-perfect fastener locations, such as a nail that is slightly less or more than 1 in. (25 mm) from the end of the shingle.

To address issues of shingle nail orientation, we should consider providing additional training to installers regarding the use of pneumatic nail guns and air compressors. The NRCA currently offers an Asphalt Shingle Installation Package as part of their TRAC (Training for Roof Application Careers) program.⁷ The training should include instruction regarding the more regular and even shooting of the nail gun to maintain more consistent air pressure and depth of nail penetration, reducing the extent of over- and underdriven nails. Installers should be trained to move with the nail gun, so the orientation of the nail is more perpendicular to the roof surface, reducing the number of angle-driven nails.

To address the issue of expert witness behavior, we need to call out unacceptable behavior when we are exposed to it. We should promote and encourage experts to seek continuing education and/or training for the subjects for which they provide opinions. Attorneys should seek to disqualify experts who are clearly not qualified to provide opinions on subjects outside of their expertise. This disqualification exercise could be as easy as identifying that the sole basis of the expert opinion is reading installation instructions and comparing them with the as-built conditions, which does not require any level of expertise as defined by the court system. This comparison could be made by anyone on the jury; an expert is not needed for such a simple evaluation. If the expert wishes to expound on their opinion to say that the imperfect installation will result in an actual failure, courts should require the expert to support

Table 1. Stakeholders associated with shingle attachment

Code bodies	International Code Council
	Canadian Building Code
Relevant industry groups	Authorities Having Jurisdiction
	Asphalt Roofing Manufacturers Association
	IIBEC
	Roofing Industry Committee on Weather Issues
	Federal Emergency Management Agency
	Institute for Building & Home Safety
Manufacturers	Various popular shingle manufacturers used in SC

that opinion with actual empirical evidence and test data.

Professional engineers and roofing consultants who continue to display a lack of objectivity, do not consider all relevant information, perform biased evaluations by only documenting perceived defects, and provide unreasonable opinions associated with excessive and unnecessary repair scopes may subject themselves to being reported to local licensing boards or associations such as IIBEC for possible ethical violations. As a self-policing profession, this is our only way to identify those who choose to behave in a less-than-honorable manner. Hopefully, the complaint process will serve to improve the behavior of the offending engineer.

RESPONSE FROM THE INDUSTRY


For purposes of obtaining additional perspective regarding the issues raised in this article, the author has distributed a draft version to various groups within the construction industry and will continue to distribute the final article to what the author considers to be some of the relevant industry "stakeholders" associated with shingle attachment, including, but not limited to, the ones listed in **Table 1** above.

Each of the stakeholder groups above has been invited to share their thoughts on any of the issues raised by this article. Hopefully, this article will serve to open further discussion regarding the true meaning of a building code violation and the associated consequences. Perhaps consideration could be given to establishing industry-wide attachment tolerances, as adopted by some individual manufacturers. Additionally, we should discuss what constitutes acceptable behavior by those retained to serve as expert witnesses, particularly when they are licensed

professionals subject to ethical standards. The author welcomes any and all responses, written or verbal, that will serve to improve and educate the industry on the issues discussed in this article.

ADDITIONAL THOUGHTS ON CONSTRUCTION LITIGATION

In the context of construction litigation, the plaintiff building owners often realize that many costs of litigation are not recoverable in a lawsuit, including attorneys' fees and expert fees. Plaintiffs always wish to maximize a claim so they can fund reimbursement for as many fees, costs, and ultimate repairs as possible. By adding a host of building imperfections that technically violate the code, the plaintiff attorney can significantly add to, or multiply, a repair scope and cost of repairs to maximize a recovery.

An improperly attached shingle roof is rarely, if ever, the primary issue in construction litigation. However, it is a common issue to supplement the real issues of a construction defect case. This article only highlights one of the "slam dunk" code violations that are being used by plaintiff attorneys to inflate repair estimates. Just as illustrated by the shingle attachment issue described above, the list of alleged issues can represent real issues that need to be addressed. However, they sometimes represent trivial issues with no consequence that are simply used to support a more expensive claim. As professional engineers, we should disconnect ourselves from the desires of our clients and honor our profession. We have a responsibility to be objective and complete in our evaluations, and we are not allowed to be advocates for our clients. Professional engineers should spend their time solving problems, not creating them. 

REFERENCES

1. Asphalt Roofing Manufacturers Association (ARMA). *Residential Asphalt Roofing Manual*. Washington, DC: ARMA, 2006.
2. National Roofing Contractors Association (NRCA). *The NRCA Roofing and Waterproofing Manual*. 5th ed. Rosemont, IL: NRCA, 2003.
3. CertainTeed. *CertainTeed Shingle Applicator's Manual*. 15th ed. <https://pdf.lowes.com/productdocuments/e62a6622-fe07-46a3-88eb-d973b3c3f562/48262010.pdf>.
4. The NRCA Roofing Manual: Steep-Slope Roofing Systems, 2017; National Roofing Contractors Association (NRCA), Rosemont, Illinois.
5. *Merriam-Webster.com Dictionary*, Merriam-Webster, <https://www.merriam-webster.com/>.
6. International Code Council (ICC). *International Residential Code*. Country Club Hills, IL: ICC, 2015.
7. "TRAC Asphalt Shingle Installation Package," NRCA, https://industry.nrca.net/eweb/DynamicPage.aspx?webcode=NRCAStorePrdDetails&site=nrca&es3_key=b42a0a12-5c9f-4b87-99de-cc1e44161e61&prd_key=EBF7FC9F-D88F-49D8-839C-6B71C2590C72.

ABOUT THE AUTHOR



DEREK A. HODGIN, PE, RBEC, CCA, F-IIBEC

Derek A. Hodgin, PE, RBEC, CCA, F-IIBEC, of Construction Science & Engineering Inc., has more than 25 years of experience as an engineering consultant. A licensed professional engineer in 23 states, Hodgin

is also registered through IIBEC as an RRO, RRC, RWC, REWC, and RBEC; and as a CCA with CSI. He is currently at the forefront of investigations of building envelope and structural components of mid-rise wood-frame construction buildings. Hodgin has investigated and testified regarding the performance of various building products, including FRT wood, EIFS, hardboard siding, and trim.

Please address reader comments to chamaker@iibec.org, including "Letter to Editor" in the subject line, or IIBEC, *IIBEC Interface*, 434 Fayetteville St., Suite 2400, Raleigh, NC 27601.

