Self-Sealing Asphalt Shingles – Technical Bulletin 3.0

Is My Roof Wind Damaged? Is Wind the Proximate Cause?

A Guide to the Various Stages of Wind Damage to Residential Asphalt Shingle Roofs and Repair Options for Each Stage

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FORENSIC ENGINEERING & FIRE INVESTIGATION

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January 2009

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Purpose

According to the Asphalt Roofing Manufacturers Association, asphalt shingles cover more than four out of five residential roofs throughout the United States. Their popularity can be attributed to several key factors, which include:

1. Comparatively low cost relative to anticipated lifespan.
2. Overall excellent performance over the average lifespan.
3. Ease of installation. Highly skilled labor is not required.
4. Low maintenance. Asphalt shingle roof systems are not maintenance free, but they require relatively little upkeep.

However, as with all man-made materials, nothing lasts forever, especially something that takes as much abuse as a roof. All asphalt shingle roofs eventually fail. And if left in place long enough, it is a logical assumption that all asphalt shingle roofs will eventually fail from wind.

Wind damage is therefore not a probability, it is an ultimate certainty. If given enough time, all roofs will eventually grow old and will be less able to resist the forces of everyday Mother Nature. Eventually, even the lightest and routine winds will become the mechanism by which a roof fails.

Yet each time a significant wind event occurs, regardless of location or severity, we frequently encounter property owners, roofing contractors, and insurance claim handlers who act with confusion and misunderstanding as they seek to determine the cause of newly discovered roofing problems, especially as they try to understand whether or not these problems were caused by a recent wind event. This paper is therefore offered in the hope that it will provide interested parties with a better understanding of asphalt shingle roofs, specifically how they perform in the wind and eventually become damaged by wind.

Proximate Cause

Proximate cause is an important legal term when studying whether or not wind is the true peril of a loss, and it is therefore important for anyone studying wind damage to understand it as well. The following example makes this easy to understand.

> *"Proximate cause" is an act which sets off a natural and continuous sequence of events that produces injury. Without the act, no injury would have resulted. Any time you act, you start a series of natural and continuous events to occur (simple cause and effect, like when you touch the surface of still water and ripples are created). Responsibility for an injury lies with the negligent act that produced the injury. For example, suppose you throw a ball that rolls down a*

hill; after the ball rolls down the hill, a stranger picks it up and throws it through a window, causing the glass to shatter; the glass shards hit a woman, cutting her arm. In this example, although you caused the ball's initial movement, your act is not the proximate cause of the injury to the woman sitting next to the window. The stranger's act is the proximate cause of her injury, and he should be the one to pay for her medical treatment.[1]

Therefore, one may frequently observe damages from wind, yet wind was not the *proximate* cause. Aside from age, there are countless human factors that can make a roof inherently prone to damage from wind. When such a prone roof eventually becomes damaged, it may become inaccurate to conclude that wind was the proximate cause of the damage. This distinction is important. It may affect insurance coverage, or affirm or limit one's ability to pursue a validly accountable party whose shortcomings only became known through wind. Put another way, wind is all too frequently nothing more than the "straw that broke the camel's back," yet all the previous straws placed on its back were the real proximate cause.

How Wind Affects Roofs

The following discussion of how wind affects a roof assumes that you have a basic understanding of asphalt shingles, specifically how they are installed, their performance expectations, and how they resist wind. For information on these subjects, we recommend the previous asphalt shingle technical bulletins in this series –Seal Strip Design, Expectations, and Failure Analysis (Bulletin 1.0); and Wind Resistance Basics (Bulletin 2.0). Both prior bulletins are available at www.donan.com.

Combined, these bulletins discuss how shingles resist the effects of wind. Specifically, they discuss the importance of correct shingle fastening, choosing nails over staples, the correct number and placement of nails, and whether hand-applied asphalt sealant is required for proper shingle installation. They also discuss how the asphalt seal strips on an asphalt composition roof are designed to perform, and how to determine why and when these self-sealing strips fail to perform as designed.

Expanding on these prior asphalt shingle bulletins, it is essential that one understand the forces that wind exerts on a roof as it passes over it, so that one can visualize the parts of any roof that would be most prone to damage and those that would be less affected, and compare this understanding with the evidence of a roof in question so that consistencies or inconsistencies can be found. This step is often critical in a "proximate cause" determination of damage. In other words, was wind really the cause of the damage or was it simply a worn-out roof (wear and tear), improper installation, manufacturing defect, etc. that is really to blame for the damage? If damages are consistent with the known effects wind has on a building, it becomes logical to conclude that wind is the true cause of loss. If, however, the damages are inconsistent with the known effects wind has on a roof as it passes over it, it becomes

[1] http://accident-law.freeadvice.com/auto/proximate_cause.htm

much more challenging to classify the damages as "wind damage," even though wind may have been the mechanism by which these damages were initially discovered. In other words, the roof may have contained one or more damages or shortcomings that had nothing to do with wind, yet it took wind to make these issues come to light. Which came first – the chicken or the egg?

Wind may apply positive or negative pressure (force) on any building surface like a roof, sometimes even both at the same time. It can be complex to analyze because it is a function of so many variables: the roof's slope, size, height, building exposure, trajectory and speed of the wind, direction of the wind, etc.

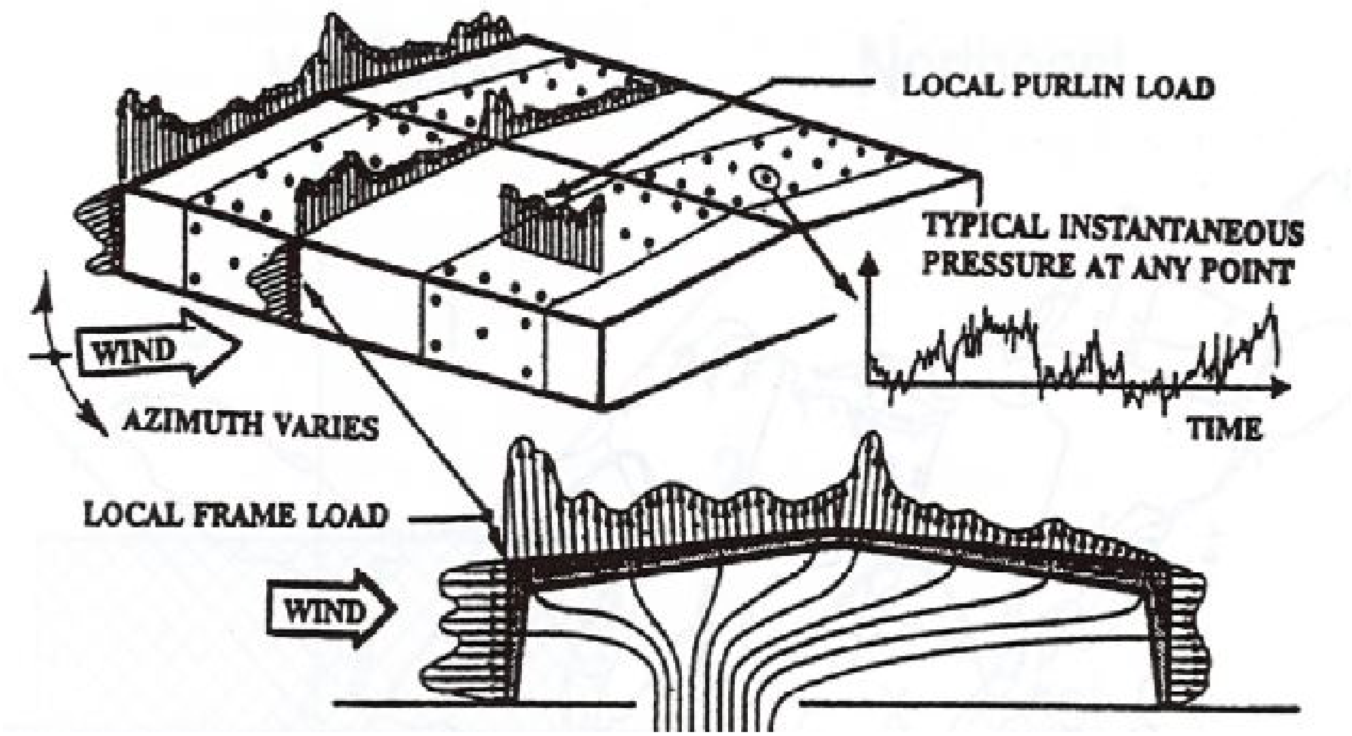


Figure 1 – Unsteady wind loads on low buildings for given wind direction (ASCE 7-02).

Fortunately, however, for the purposes of simply understanding what parts of a building are most prone to damage from wind (where wind exerts the most positive or negative force), the effects of wind can be simplified. Engineers routinely rely on the design document ASCE 7 to design against the forces wind will apply to a roof. For this discussion, we'll rely heavily on its illustrations to show how wind commonly applies force(s) on basic roof geometries.

Is Wind a Positive or Negative Force?

Answer: it depends.

Oversimplified, the side of a building facing into a wind (the windward side) will experience a positive force (positive meaning that the wind is pushing "into" the building). However, depending on the slope of the roof and trajectory of the wind, as air encounters the windward slope of a roof, the wind may cause either positive or negative pressure on the windward roof slope. In other words, wind may either push on the windward roof slope or cause it to want to pull up (lift up). In this way, a roof may begin to perform like an airplane wing, creating lift as wind rushes over its surface.

As wind crosses over the ridge or hip of a roof, or the perimeter (edge) of a roof or building, the wind tries to maintain its prior speed and direction, yet the building surface abruptly "pulls" away from the wind (or vice versa –the wind abruptly "pulls" away from the building). This creates a vacuum or suction effect, and negative air pressure is again the result. Put another way, wind passing over the ridge, hip, or edge of a roof almost always creates a vacuum, also described as "lift." The following illustrations help describe this phenomenon, which scientists refer to as the "Bernoulli Principle." The arrows imply whether wind "pushes" into an exemplar building or "pulls" away from it, creating a vacuum, suction, and lift (a drop in air pressure).

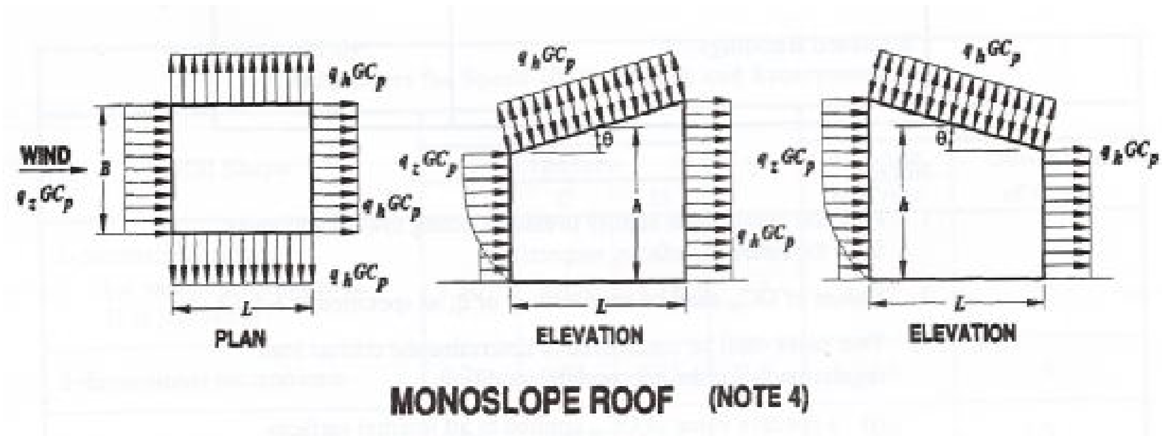


Figure 2 – Monoslope roofs, main wind forces for enclosed or partially enclosed buildings (ASCE 7-02).

Note: "Plan" view is simply a bird's-eye view of the exemplar building.

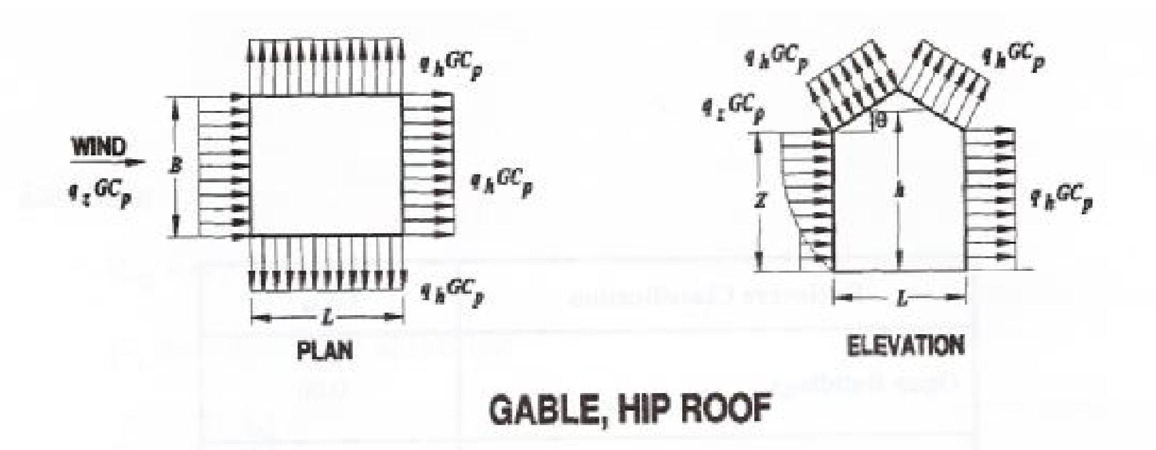


Figure 3 – Gable roofs, main wind forces for enclosed or partially enclosed buildings (ASCE 7-02).

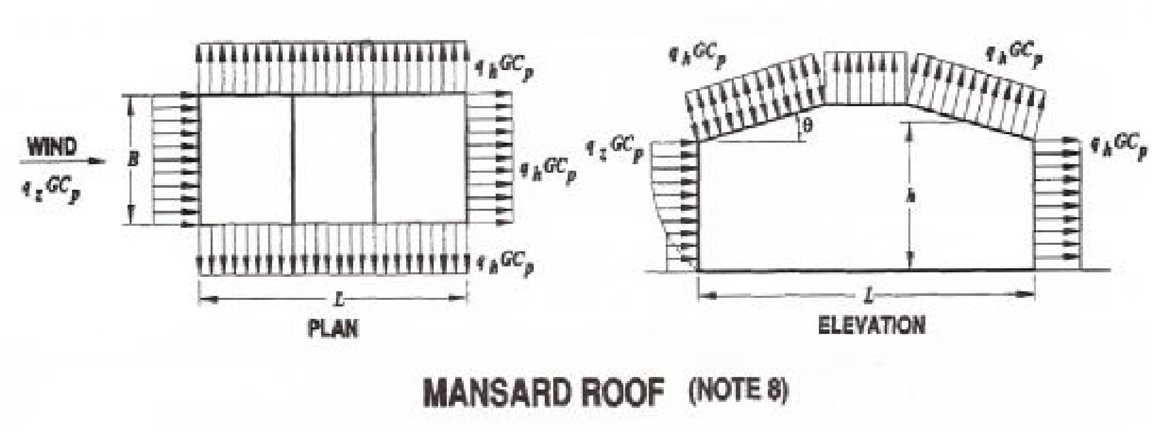


Figure 4 – Mansard roofs, main wind forces for enclosed or partially enclosed buildings (ASCE 7-02).

What Parts of a Roof Are Most Affected?

Answer: Wind will apply greater loads (forces) to areas that correspond to changes in the building geometry. In other words, for a simple gable roof, the middle of the roof slope is least affected, whereas the corners, eave, ridge, and rakes (sides) are more affected. The following illustrations help describe what parts of simple roofs are more affected by wind. These results can easily be applied to more complex roof geometries.

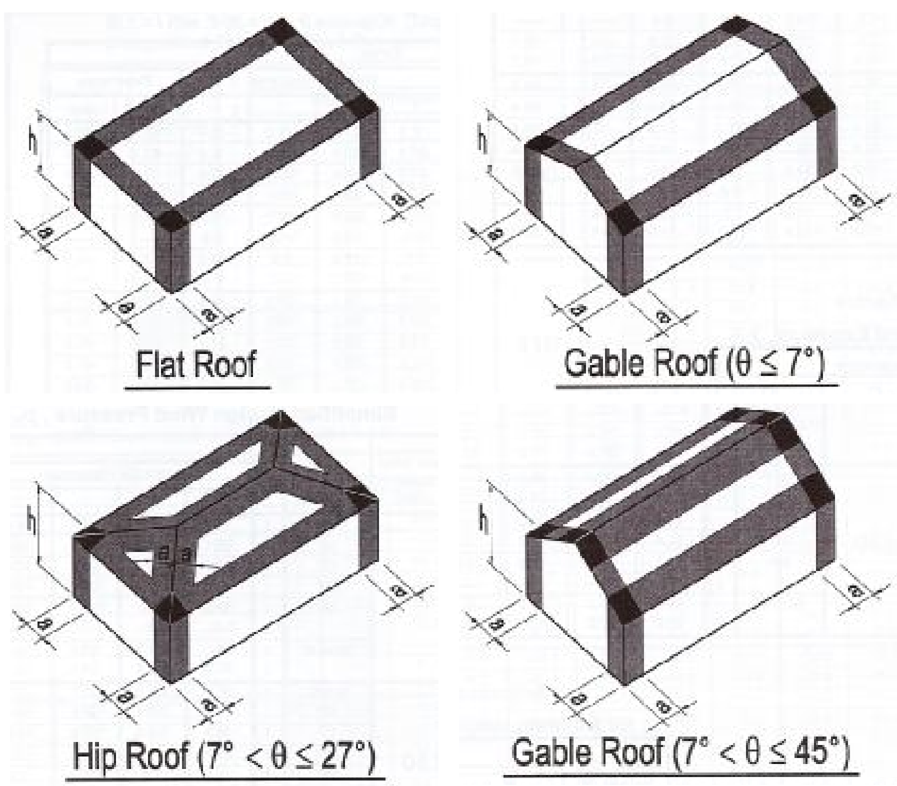


Figure 5 – Enclosed buildings, design wind pressures (ASCE 7-02)

While broad, one can now arrive at a few key conclusions about how wind affects a roof.

1. Wind usually exerts lift on a roof. Therefore, in wind losses roofs are usually not damaged by being pushed on, but by being pulled up.
2. The parts of a roof most affected by wind are the corners, followed by the eaves, rakes, hips, and ridges.
3. Wind least affects the fields of a roof, with diminishing effect the closer one moves toward the center of a roof slope.
4. Assuming wind is the proximate cause of the damage, roof damages from wind should logically initiate in the areas where wind exerts the most force on a roof.
5. Wind damages that occur in areas of a roof that are less affected by wind than are other more susceptible areas that remain undamaged warrant special attention, as these damages may not be, at least in part, attributable to wind. In other words, while wind may have made these damages visible, other factors may have played a key role in the cause of the damage.

With these conclusions in mind, now re-evaluate the photograph of the wind-damaged roof on the cover page of this bulletin. Is there a pattern of damage? Is that pattern natural or man-made? Do these damages correspond to areas of the roof that are most affected by wind?

Obvious Wind Damage & Damage from "Severe" Wind

Obvious wind damages often occur from winds that can be classified as "severe," or by winds that approach that speed. Note, however, that winds need not be severe or anywhere near that speed to cause damage or cause pre-existing damages to become visible, hence why so many wind claims are often confusing. Regardless, damages that occur where wind is the overwhelming proximate cause often arise during "severe" winds or winds approaching this description.

What is a "Severe" Wind?

Severe
səˈvɪər Pronunciation **[**s*uh*-veer**]**
–adjective, -ver·er, -ver·est.

1. Harsh; unnecessarily extreme: *severe criticism; severe laws.*
2. Serious or stern in manner or appearance: *a severe face.*
3. Grave; critical: *a severe illness.*
4. Rigidly restrained in style, taste, manner, etc.; simple, plain, or austere.
5. Causing discomfort or distress by extreme character or conditions, as weather, cold, or heat; unpleasantly violent, as rain or wind, or a blow or shock.
6. Difficult to endure, perform, fulfill, etc.: *a severe test of his powers.*
7. Rigidly exact, accurate, or methodical: *severe standards.*

More to the point, we must look to the guidelines offered by codes, standards, and roofing material manufacturers to understand more clearly what the term "severe" means in the roofing industry. For engineers and other building designers, we again find guidance in ASCE 7. The following map of the eastern United States illustrates this guide's criteria that buildings must be designed to resist.

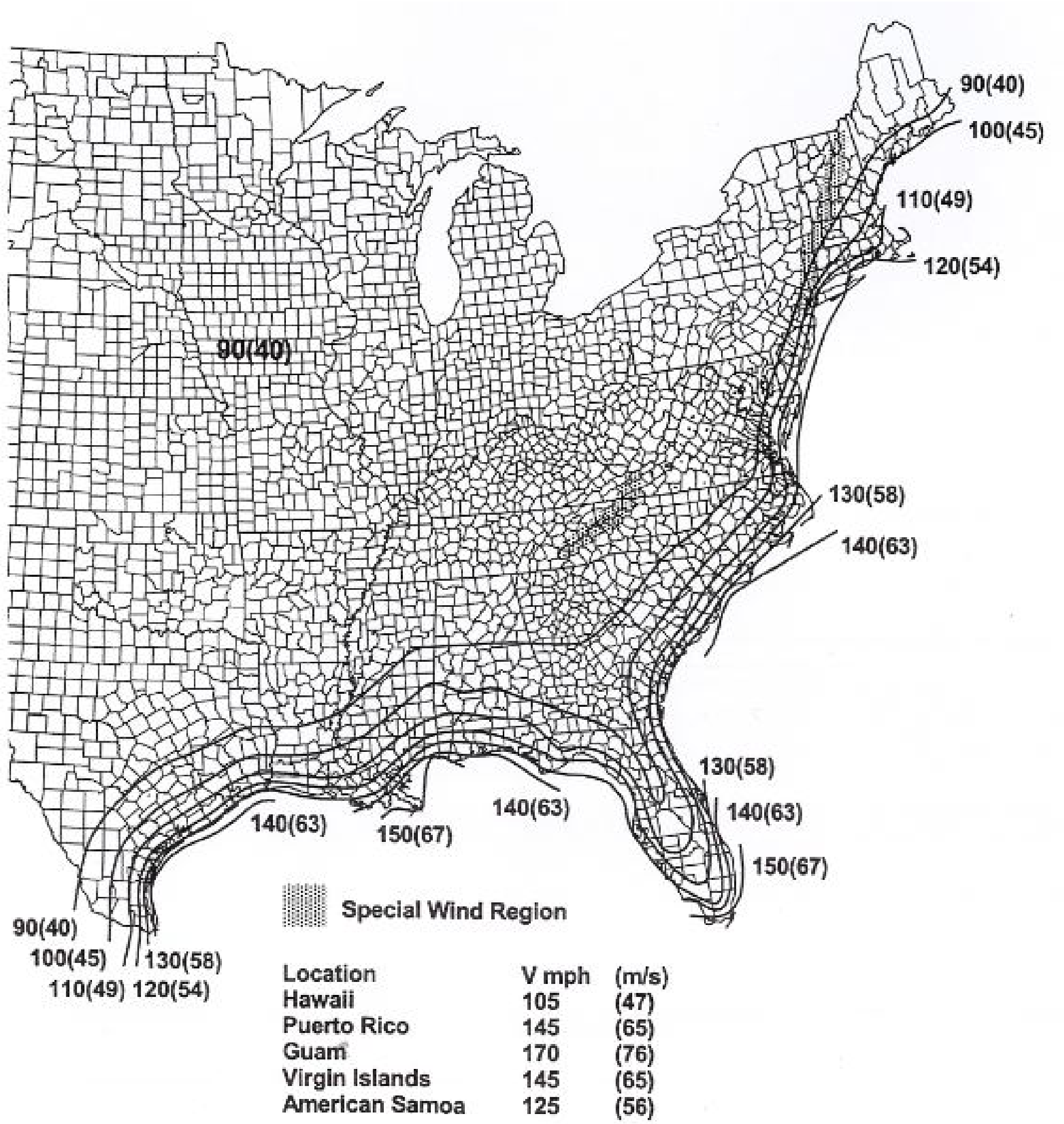


Figure 6 – Basic Wind Speed (ASCE 7-02)

As seen in Figure 6, 90 miles per hour (MPH) is the basic design wind speed for most of the eastern U.S. unless one approaches the coastline, where the design wind speed increases to guard against hurricanes. While not shown, 90 MPH is also the basic design wind speed for the western U.S., minus special wind regions (known high-wind areas in mountainous terrain), and Washington, Oregon, and California, where the design wind speed is 85 MPH.

While residential property owners, residential roofing contractors, and roofing manufacturers often allege that 90 MPH is an overly burdensome criterion for them to meet, note that the 2003 International Residential Code has adopted the same design wind speeds as those outlined in ASCE 7. Thus 90 MPH gains additional credibility as a prudent threshold for a "severe" wind speed.

Regardless, the residential roofing industry fails to adhere to this design criterion. To illustrate the residential roofing industry's position on wind resistance, it is convenient to evaluate the wind warranty provisions for several major asphalt shingle manufacturers across comparable products offered by each.

Shingle Design	Manufacturer	Warranty Duration	Wind Speed Criteria	Wind Warranty Duration
Conventional 3-Tab	Owens Corning	20 or 25 years	60 mph	5 years
	GAF/ELK	20, 25 or 30 years	60 or 80 mph	3 or 5 years
	CertainTeed	20, 25 or 30 years	60 mph	3 or 5 years
	Tamko	20 or 25 years	60 mph	5 years
Imitation Dimensional	Owens Corning	30 years	80 mph	5 years
	GAF/ELK	-	-	-
	CertainTeed	30 years	70 mph	5 years
	Tamko	-	-	-
Conventional Dimensional	Owens Corning	30 years	70 mph	5 years
	GAF/ELK	30 years	100 - 110 mph	5 years
	CertainTeed	30 years	70 mph	5 years
	Tamko	30 years	80 mph	5 years
Heavyweight	Owens Corning	30 years	110 mph	5 years
	GAF/ELK	40 years	110 mph	5 years
	CertainTeed	40 years	80 - 110 mph	5 years
	Tamko	40 years	80 - 110 mph	5 years
Lifetime	Owens Corning	50 years	90 - 130 mph	10 years
	GAF/ELK	50 years	130 mph	10 years
	CertainTeed	50 years	110 mph	10 years or 5 years
	Tamko	50 years	90 - 130 mph	10 years

At quick glance one can see that the asphalt shingle roofing industry produces products that are designed to resist winds as low as 60 MPH and up to as high as 130 MPH. However, given that the most popular products are those that are least expensive, the overwhelming majority of all asphalt shingle roofs throughout the U.S. are designed for 80 MPH winds or less. Moreover, since the manufacturers limit these wind performance guarantees to only the first few years of a residential roof's probable lifespan, we can conclude that these roofs become even less resilient to wind as they age. Indeed, we see all too frequently asphalt shingle roofs that fail from wind speeds well below 60 MPH.

In reality, not only are most asphalt shingles not manufactured to resist winds that buildings should be designed against, but after the first few years of weathering, many asphalt shingles may approach only half of the wind resistance that codes and design standards require buildings to resist without damage.

Therefore, a disagreement exists between design standards, codes, and the residential roofing industry. While it is clear that 90 MPH is a reasonable design standard, and arguably the threshold by which all residential roofs should be made to perform without damage, the roofing industry has succumbed to lower wind resistance standards, as low as 60 MPH. Consequently, for the purposes of evaluating a wind-damaged residential roof, we commonly define damages following winds of 60 MPH or higher as wind induced where wind was the proximate cause.

Examples of Damage from "Severe" Winds (60 MPH or Greater)

Photograph 1 – A gable roof that initially failed along the rake edge. Damage gradually progressed into the roof as the winds continued.

Photographs 2 & 3 – A gable roof that initially failed along the rake edge. Note in the close-up where wind ripped the shingles off, leaving bits of shingle behind around the nail heads. Such evidence is common with severe winds.

3.13-1. Residence. Ocean-front building with some shingles lost on windward side.

3.13-2. Residence. On this roof, shingles were torn loose from metal edge on the windward side.

Photographs 4 & 5 – Wind damages initiating along the eaves of a house damaged from Hurricane Katrina (Roofing Industry Committee On Weather Issues - RICOWI).

As seen in the above examples, wind damages from winds that are "severe" generally initiate in the areas of known susceptibility based on wind direction and roof geometry. Specifically, roof corners, eaves, rakes, hips, and ridges are areas where failures may be expected to initiate. It is then clear why shingle fastening in these areas is so key to any roof's ability to resist the damaging effects of wind.

Avoidable Wind Damage

Avoidable wind damages are those damages that occur to roofs from winds that we would not expect to be damaging; otherwise classified as winds that are clearly not "severe" in speed or duration. Unfortunately, such damages are disturbingly commonplace. While avoidable, they are routine in severe weather events as one travels away from the area of "severe" influence, such as in a large wind event like a hurricane or significant tornado. They are avoidable because they would have not occurred, or would not have occurred to such an appreciable extent, had the roof been designed, specified, manufactured, installed, maintained, etc. properly. Improper installation is the most common cause of loss, or the reason the damages were exacerbated. Indeed it is a sad truth, but the overwhelming majority of all asphalt shingle roofs studied contain multiple installation shortcomings ranging from routinely subtle to blatant which make roofs more prone to damage.

Avoidable residential roofing wind damages are of particular interest to an insurance company honoring restoration costs under their wind loss provisions because a potential for subrogation recovery may exist. Residential roofing subrogation generally requires a sizeable loss to be worthy of pursuit. Yet when a roof is less than five years old and the installation contractor is known, such claims are worthy of consideration if installation issues are a known proximate cause or significant contributor to the loss.

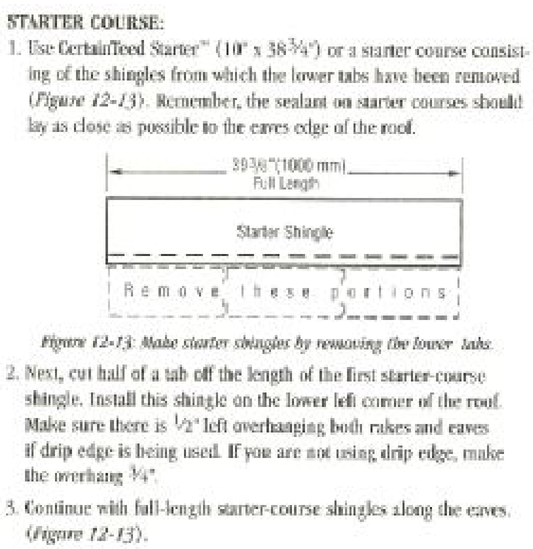
Installation shortcomings are generally consistent. Several categories are:

1. Improper starter course and/or rake edge installation.
2. Vertical racking.
3. Improper nailing – high nailing, over-driven nails, and nail pops.

Improper Starter Course and/or Rake Edge Installation

Installers frequently fail to install the first course of shingles on a roof properly. Proper installation requires the use of a shingle product specifically designed for use as the starter row on eaves or rakes (many manufactures offer such a product) or requires that the tabs of a conventional shingle be trimmed and the remainder installed so that the seal strip is on top of the drip edge. However, many skip this step and instead install a common three-tab or dimensional shingle upside down along the eave or rake. In doing so, the installer fails to locate a shingle seal strip along the leading edge of the roof, creating a full course of shingles along the eaves or column of shingles along the rakes that will never seal down and is ripe for damage from otherwise undamaging winds.

Correct:



STARTER COURSE:

1. Use CertainTeed Starter™ (10" x 38¾") or a starter course consisting of the shingles from which the lower tabs have been removed (*Figure 12-13*). Remember, the sealant on starter courses should lay as close as possible to the eaves edge of the roof.

Figure 12-13: Make starter shingles by removing the lower tabs.

2. Next, cut half of a tab off the length of the first starter-course shingle. Install this shingle on the lower left corner of the roof. Make sure there is ½" left overhanging both rakes and eaves if drip edge is being used. If you are not using drip edge, make the overhang ¾".
3. Continue with full-length starter-course shingles along the eaves. (*Figure 12-13*).

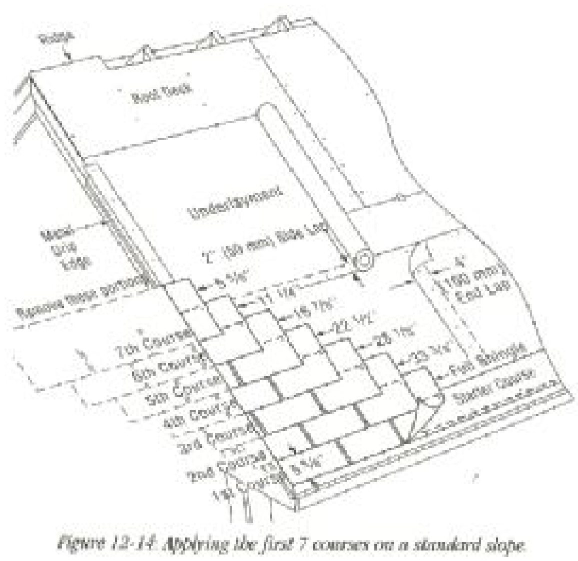


Figure 12-14: Applying the first 7 courses on a standard slope.

Figures 7 & 8 – The starter course along the eaves of a roof should align the seal strip directly above the drip edge and below the bottom edge of the first full course of shingles applied (CertainTeed Shingle Applicators Manual).

Incorrect:

Photograph 6 – Wind damaged shingles along the first full course of this roof were blown off because the underlying starter course was not installed correctly. This is an example of the common mistake of simply installing a full three-tab shingle upside down as the starter course.

Photograph 7 – Improperly installed full-width three-tab shingle on its side along the rake edge of this roof. As a result, the shingles overlying this rake edge will never seal. Where is the drip edge? Why does the underlayment not extend to the edge?

Vertical Racking

Vertical racking is a method of installation where the shingles are installed in consecutive columns as one works laterally across a roof slope. Compared to the diagonal method (staggering shingles laterally as one works vertically up a roof), the vertical racking method is complex and often damaging to the shingles as they're being installed. Its complexity hosts a wide variety of other installation shortcomings, which include commonly omitting required nails and creating vertical lines of shingles that will never have the opportunity to seal as designed. Both installation shortcomings create roofs that are inherently prone to damage from otherwise undamaging winds, and an unappealing visual appearance is often an easy indicator that a roof was installed using this method. For these reasons, most manufacturers discourage or do not approve of this installation method, and it is similarly not approved by some leading industry organizations.

Photograph 8 above – An installer demonstrating proper vertical racking. Note how far he must uplift and bend back the previously-installed shingle to install the required end nail. For this reason, this nail is often omitted: a key installation mistake that leads to wind damage. (Source unknown)

Photograph 9 above – A roofing crew taking numerous safety risks as they make many errors installing this roof using the vertical racking method.

Photograph 10 – Contractors who install shingles via the vertical racking method commonly create roofs that contain visually unappealing lines as seen in this example. Moreover, these lines generally correspond to lines of unsealed shingles: shingles that are inherently prone to damage from otherwise undamaging winds.

Photograph 11 – Loose shingles spaced exactly three-tabs apart are an easy indication of vertical racking installation damage and have nothing to do with wind. Often these shingles become more visible after a strong wind, but were previously loose and never sealed due to the poor practices of the installer.

Photograph 12 – Loose shingle corners spaced exactly three shingle tabs apart are an unfortunate byproduct of an installer damaging the roof during vertical racking shingle installation. As a result, this roof is inherently prone to unnecessary wind damage as pointed out by the arrow.

Photograph 13 left – This consistent pattern of vertical tears directly above keyways and diagonal tears across shingle corners is evidence of the installer damaging the roof as he installed it during the vertical racking method.

Photograph 14 right – Loose shingles that do not correspond to tears, creases, or broken seal strips and that occur in vertical lines on a roof are a clear indication of the vertical racking method of shingle installation and are not related to wind.

It is nearly impossible to install a roof using the vertical racking method that does not result in a roof prone to wind damage, UNLESS the contractor takes the time and makes the extra effort to hand-seal each strenuously uplifted shingle tab. Unfortunately, since the practice of hand sealing is time consuming and laborious, it rarely occurs, resulting in most vertically racked roofs being inherently prone to damage from otherwise undamaging winds, as is illustrated in the photograph on the cover of this bulletin. Note these other examples of vertically racked roofs that have also become damaged from wind due to poor practices of the roofing contractor.

3.03-1. Living Waters Church. Torn tabs at unattached ends of shingles follow a vertical pattern.

3.03-2. Living Waters Church. A closer view of torn shingles shows missing nails in alternating courses.

Photographs 15 & 16 – An asphalt shingle roof on a church that was damaged in Hurricane Katrina. The damages clearly illustrate the vertical racking method of installation. Note the lack of damages to the roof's rake, ridge, corners, and eave that clearly indicates that it is the contractor's practice, not the wind, which is the proximate cause of loss. (RICOWI)

3.15-1. Residence. This roof was installed using a vertical "racking" installation method, which resulted in significant damage to many of the 3-tab shingles.

3.15-2. Residence. Fasteners were missing on alternating courses of shingles.

Photographs 17 & 18 – An asphalt shingle roof that was damaged in Hurricane Katrina. The damages clearly illustrate the vertical racking method of installation. (RICOWI)

Improper Nailing – High Nailing, Over-driven Nails and Nail Pops

High Nailing

“High nailing” is an industry term used to describe improper shingle installation where the shingles are nailed too high, either in the asphalt sealant strip or above it. Proper installation of conventional three-tab and dimensional asphalt shingles requires no fewer than four nails per shingle, installed in the space between the shingle tab cutouts and the asphalt sealant strip or in a specific line or area usually marked on the top side of the shingle.

While common, installation of nails through the asphalt sealant strip is a critical mistake that prevents the strips from adhering as designed, thereby making the shingles susceptible to blow off. Installation of nails above the asphalt sealant strip robs the shingle below of half of its intended fasteners. In other words, while four nails should be driven through a common three-tab shingle, eight actually penetrate it when the overlying shingles are properly installed: four driven through the shingle itself and four driven through the shingle tabs that were installed above it. When shingles are high nailed, those installed too high miss the underlying shingle entirely, thereby robbing the underlying shingle of half of its intended fasteners. High nailing is therefore a major cause of wind damage, frequently from winds that would have been otherwise undamaging.

Photographs 19 & 20 – High nailing shingles prevents the seal strips from coming into contact with the overlying shingle tab, thereby keeping it from sealing, and often robs the underlying shingle of nails that were supposed to help fasten the underlying shingle to the roof.

Photographs 21 & 22 – A wind-damaged shingle tab (as indicated by the crease going through the shingle mat) that was allowed to be damaged by wind by the installer, who high nailed the underlying shingle.

Over-driven Nails

Over-driven nails are a common condition in asphalt shingle residential roofing associated with an installer's misuse of a nail gun. Over-driven nails are simply nails that were ejected from a nail gun with too much velocity (over-pressure in the gun), causing them to go into or completely through the shingle they were intended to fasten.

Over-driven nails frequently occur as workmen begin using compressors and nail guns in the morning when temperatures are cooler. As time passes and outside temperatures rise dramatically (middle of the summer), compressor pressures gradually increase unless they're monitored and regulated by the workmen. Eventually, the pressures in the nail gun are so high that nails frequently go all the way through a shingle, whereas they were being properly installed earlier that same day. This preventable condition can result in entire sections of a roof being unattached, and clearly prone to oftentimes dramatic wind damages.

Photographs 23 & 24 – Over-driven nails that provide no benefit to the roof and make it prone to wind damage.

Photographs 25 & 26 – Over-driven nails have allowed this group of shingles to "slide" down the roof, creating the wrinkle highlighted by the arrow. The entire group of shingles was loose and ready to be blown off by an otherwise non-destructive wind.

Photographs 27 & 28 – A stair-stepping crack through a shingle roof that widens from top to bottom is an indication of shingle sliding. The condition is a consequence of over-driven nails yet is often improperly blamed on wind, although it justifiably does create a roof that is easily damaged by wind.

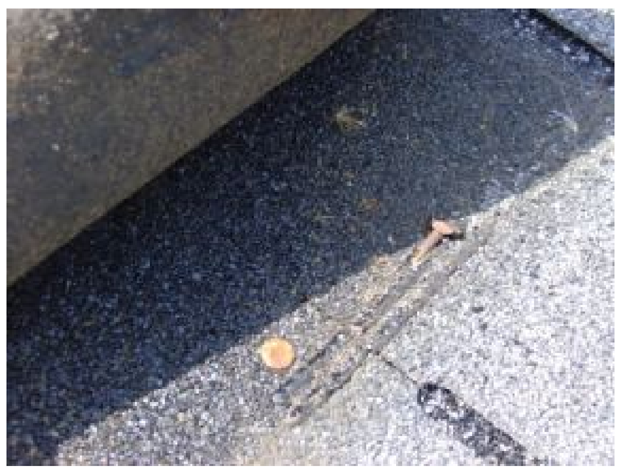
Photograph 29 - Lines of wrinkles in a roof are an indication of shingle sliding. In this instance, it was caused by both over-driven nails and an insufficient number of nails being installed through each shingle. It is not related to wind, although it was originally blamed on wind.

Nail Pops

The outward progression of a nail fastening a shingle to a roof deck, commonly referred to as a "nail pop," can distress, uplift, and/or puncture an overlying shingle. When it does not noticeably uplift or puncture the shingle, this type of distress can often be mistaken as hail damage. However, when it uplifts a shingle, thereby raising its profile and exposure to the wind, nail pops are a common cause of unnecessary wind damage.

Nail pops are common on roofs and can occur from various adverse conditions. They are often blamed on poor attic ventilation, moisture in the roof deck, expansion and contraction of the roof deck (especially in plank decking), etc. However, experience teaches that the real culprit is usually man-made. Common causes of nail pops are having too little pressure delivered to a nail gun, improperly sized nails, incorrectly using smooth-shank nails, an installer bending over a crooked nail, or installing decking nails that fail to penetrate into the roof framing (which results in loose decking, itself a common cause of wind damage).

Regardless of cause, wind damages resulting from nail pops are almost always avoidable if the roof in question had been prudently maintained. Despite most property owners' beliefs, no roof is "maintenance free." While some require more maintenance than others, all roofs require upkeep and maintenance to perform as intended over the designed effective life of the roofing material. However, most think that a roof is "out of sight, out of mind," and therefore it is commonly neglected until something draws attention to frequently long-term and preventable problems.



Photographs 30 & 31 – While not yet blown off, this crooked nail simply bent over by a lazy installer has made this shingle inherently prone to damage from wind.

Photographs 32 & 33 – A common nail pop creating a shingle tab that is inherently susceptible to damage from otherwise undamaging winds.

Photographs 34 & 35 – This nearly brand new roof was severely damaged in a routine summer thunderstorm because the contractor failed to use enough nails, failed to hand seal shingles on the steep slopes of this roof, and used nails with a smooth shank that were clearly too short for this application.

Subtle Wind Damage & Damage Allegations

We classify wind damages to conventional asphalt shingles as a loss in the integrity or functionality of the shingle attributable to wind. More specifically, torn and/or creased shingles readily fit this criterion, and therefore there is little debate about whether or not a torn/creased shingle is or is not wind damaged, even if the damages were allowed by something that could have been controlled or altogether prevented.

However, as seen in numerous prior examples, unsealed shingles are not by themselves a criterion for wind damage. To that point, all roofs are initially unsealed, and many never seal as designed. Yet it is here where the issue of damaged versus undamaged becomes unnecessarily more contentious, usually due to a lack of understanding.

At issue are shingles that are not creased, torn, or otherwise containing visual and clear evidence of failure that may be reasonably attributed to wind, but are nonetheless loose and unsealed. A "finger loose" shingle also fits this description, where it is lightly sealed but can be uplifted with slight fingertip lifting, because such a shingle may have been made loose by wind but has now slightly re-adhered. Is wind the cause? Is it damaged or not? Does it require replacement or repair? How can it be repaired?

The answers begin in an interpretation of the shingles, specifically the areas surrounding the asphalt seal strip. The loose shingle must be gently lifted so that the underside of the overlying shingle can be studied, the seal strip intended to adhere the two can be viewed, and the underlying shingle can be observed.

Specifically, a minimum requirement to support a position of wind damage surrounds whether or not ANY delamination of either/both the top and bottom shingle (not the seal strip, but delamination in the top or bottom shingles themselves) has occurred during a previous separation along the seal strip that bound the two together. If delamination has occurred, an argument in favor of wind damage cannot be refuted. If no delamination has occurred, an argument in favor of wind damage cannot be supported.

This criterion is irrelevant of wind speed, shingle type, age, professionalism of the installer, etc. It is simply based on whether or not the material (asphalt shingle(s)) has sustained a permanent loss in integrity or functionality, where the most probable cause of loss is wind. If either the top or bottom shingle is delaminated anywhere along the seal strip, that shingle is "damaged." If, however, the shingles are loose, but there is no delamination along the seal strip or any other evidence to support wind damage (creasing and/or tearing), one must assume that the shingle is loose from one or more of the countless natural and man-made causes of loose roof shingles. This approach is intended to be reasonable, fair, and impartial.

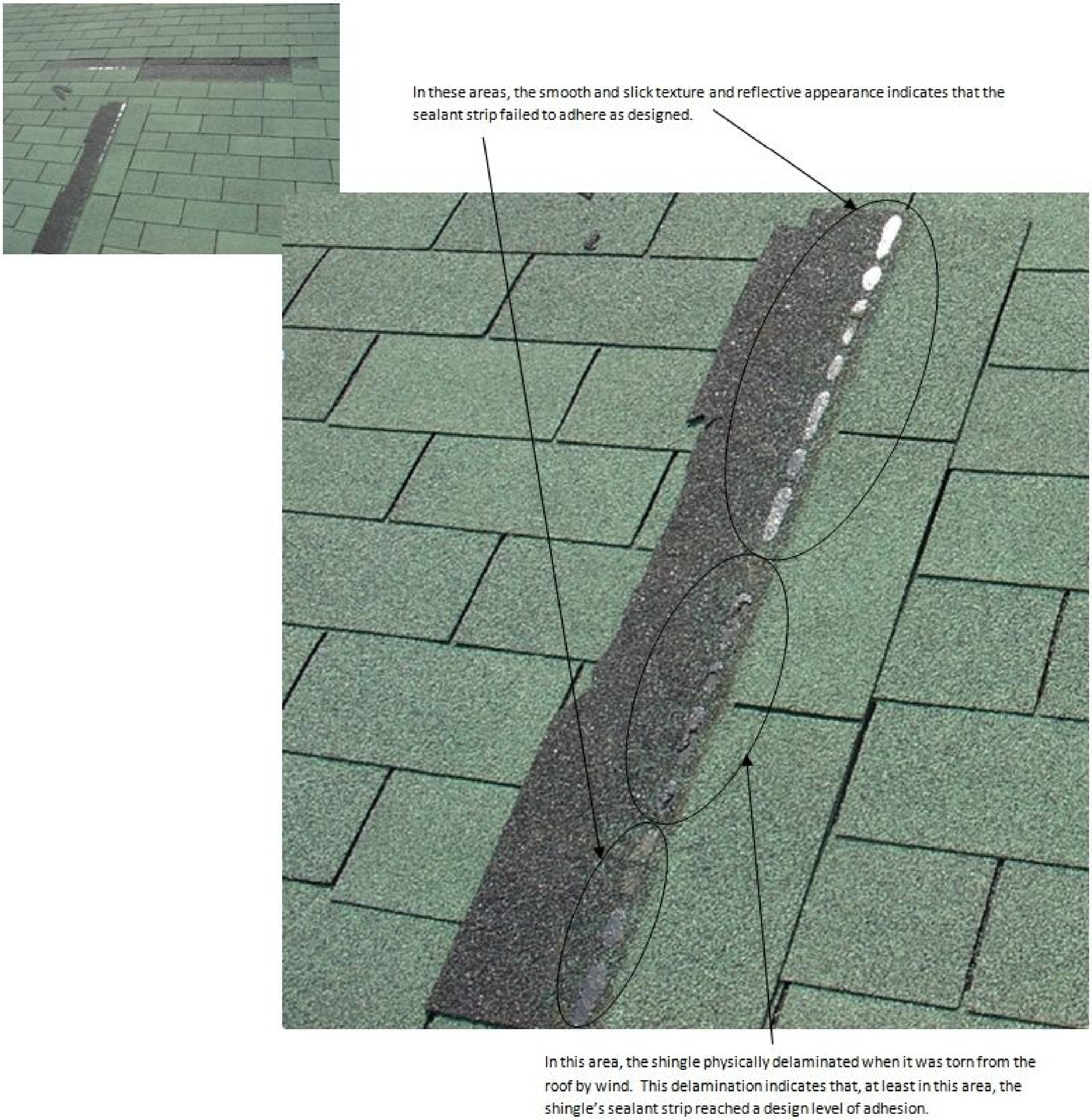
Creased and/or Torn Shingles – Clear Wind Damage

Photographs 36 & 37 – A diagonal crease through the keyway to the butt edge of a shingle is indicative of wind damage made possible because the corner area of the shingle did not seal down properly as designed. A horizontal crease across the top third of a shingle tab indicates that the entire seal strip failed to adhere as designed.

Photograph 38 – Both creased and torn shingle tabs are visible. Note, the torn and broken-back tab exposes nails improperly installed through the asphalt seal strip, which were found throughout this roof and are the proximate cause of this loss.

Photograph 39 – Valid wind damages commonly occur around roof penetrations where shingles lay on top of flashing, versus an underlying shingle with a seal strip keeping the two held down together. The proximate cause of this loss is a human error, as these shingles should have been hand sealed to the flashing. Nonetheless, it is a valid wind loss. Another potential cause may be shingle abuse from the installation of the plumbing vent. However, since wind cannot be ruled out and because the damages are consistent with wind, wind damage is a valid position.

Seal-Strip Delamination – Subtle Yet Valid Wind Damage

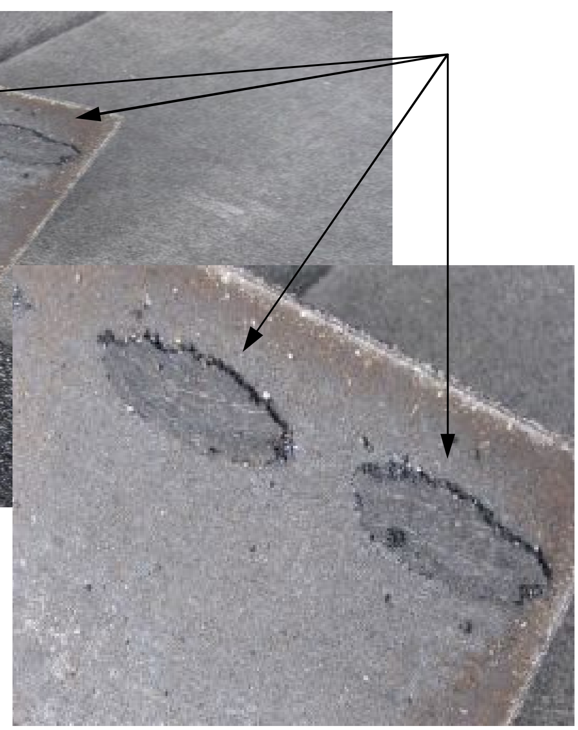


Photographs 40 & 41 – A roof that has sustained valid wind damage. Closer study illustrates the proximate cause was only partial adhesion of the asphalt seal strips. Large areas of effected shingles were entirely unsealed, whereas small sections were lightly sealed, and sporadic areas were sealed as designed as indicated by shingle delamination.

Photograph 42 – The majority of this shingle failed to seal as designed. However, the delamination confirms that it was at one time adhered properly in a small spot, and therefore a claim of wind damage is supported.

Photograph 43 – The uplifted shingle in this photograph was overwhelmingly unsealed. However, since a few spots adhered as designed and delaminated when pulled apart, regardless of creasing or tearing, a position of wind being the cause of loss cannot be overruled.

Photograph 44 – An example of isolated shingle delamination along a seal strip. Although the remainder of the tab never sealed, because this area did, a claim of wind damage is validated even if the shingle wasn't torn.



Photographs 45 & 46 – The spots of valid wind damage (delamination along the seal strip) are indicated.

Loose Shingles – Not Wind Damage

Regardless of whether or not wind lifted the shingle, even if it separated a seal strip that had some marginal adhesion, a loose shingle by itself does not qualify it as a "wind-damaged" shingle. WHY?

- Because a loose shingle is not a damaged shingle – there's no direct physical loss to the material.
- Because all shingles are loose at the beginning of their lifespan, and many naturally become loose as a roof weathers and ultimately fails from deterioration.
- Because a loose shingle without physical loss from wind can be easily re-adhered and remain in service as part of prudent maintenance.
- Because loose shingles are so common that all roofs are expected to have some loose shingles, regardless of any specific wind event.

Photographs 47 & 48 – This new roof was studied on a windy day when strong but far from severe winds were flapping loose shingles around the rakes, corners, and eaves of this roof. However, the shingles were not creased, torn, or delaminated; therefore, although wind is lifting the shingles, wind has not damaged the shingles. There's been no direct physical loss from wind…yet. The proximate cause of this condition is not wind, but over-driven nails that were also high nailed. If left uncorrected, valid wind damages are inevitable.

Photographs 49 - 52 – Classic examples of shingles that have been lifted by wind and are no longer lying flat, yet they are not “wind damaged.” The shingles were lifted by wind without being torn, creased, or without delaminating the seal strip. Therefore, they were loose before, and even though they are now uplifted from windborne debris, they have not yet sustained a direct physical loss (damage). They can be properly repaired by removing the debris and hand sealing, or they can be left in place to be soon validly damaged by wind.

Photograph 53 – A leaf blower is being used to illustrate the phenomenon where wind uplifts a previously loose shingle and yet no damage is caused.

Photograph 54 – A leaf blower being used to highlight shingles that were previously unsealed, yet the lack of proper adhesion was previously unknown. The shingles in this example are not being damaged by wind, but are certainly prone to future damages from otherwise non-damaging winds.

Photographs 47 through 54 illustrate important and commonplace conditions. Loose shingles, without evidence of direct physical loss, are frequently alleged as "wind damaged." Regardless of whether this accusation is made through ignorance or bias, it cannot be supported because all shingles are installed loose with no guarantee of ultimate seal strip adhesion. Shingles commonly never seal as designed, or seal at all, even on roofs installed by the most professional contractors using top-of-the-line shingles. It is therefore unreasonable to assume that all shingles on a roof are sealed, and sealed properly, and then that without other indications of direct physical loss, any loose shingle is by itself criteria for wind damage.

How Should Loose Shingles Be Maintained or Repaired?

Loose shingles are an inherent part of the asphalt shingle roofing industry. They're so common that one may reasonably anticipate that nearly all roofs have some amount of loose shingles, and indeed that some loose shingles may ultimately seal and others that are sealed may naturally become loose. Therefore, to maximize the performance of an asphalt shingle roof, the roof should be the focus of preventive maintenance, which includes repairing loose shingles as they are identified.

Hand sealing is the best approach to maintaining loose shingles. The following recommendations from CertainTeed's Shingle Applicator's Manual offer a step-by-step process for replacing shingles. Similar processes may be found on the World Wide Web, in asphalt shingle installation guides, or in do-it-yourself home repair journals.

REPLACING SHINGLES

The need to replace a relatively small number of shingles can happen at any time during the life of a roof.

- A recently installed roof might show signs of damage that occurred during installation especially if the roof was applied during very cold or very hot weather. During a cold weather installation, product brittleness could result in cracked or broken shingles, while during hot-weather, personnel and equipment can easily dislodge granules or asphalt (scuffing).
- At any time during the life span of a roof, damage can result from overhanging trees, windstorms, or installing an antenna or other device that penetrates the surface.

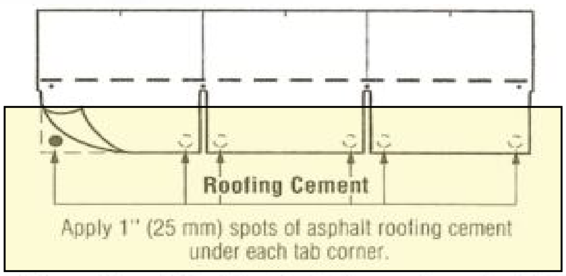
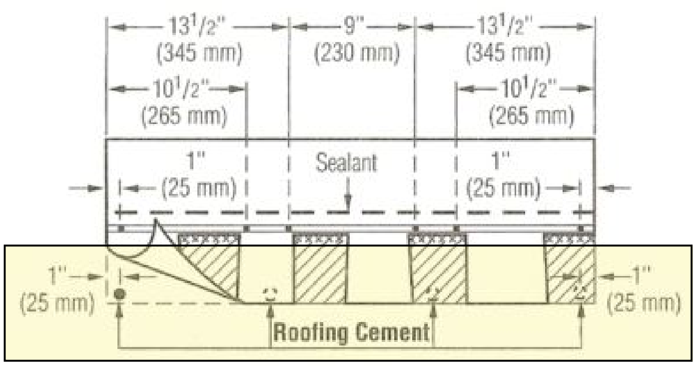


*Figure 12-4: Use **four** nails and six spots of asphalt cement on steep slopes.*



Replace damaged shingles as follows:

1. Carefully break loose the seal of the tabs of selected shingles in three courses:
   (1) all tabs of the shingles to be removed,
   (2) the tabs of shingles immediately above the shingles to be removed (that overlay the shingles to be removed), and
   (3) the tabs of shingles in the second course above the shingles to be removed.

   IMPORTANT: In hot weather it is more difficult to break loose the sealant from the tab; in cold weather, simply use a simple pry like a wide-blade putty knife. In hot weather, it may be necessary to slice the sealant with a knife and carefully separate it from the tabs to avoid causing damage to the remaining shingles.
2. Remove each nail from any shingle to be removed by inserting a pry under the shingle at the site of the nail and gently raising it slightly. Push the shingle down along the shank of the nail and then pull the nail out completely.
3. Using the same technique, remove the nails from the shingles in the course above that also penetrate the damaged shingles.
4. Slide out the damaged shingles.
5. Insert a new shingle of the same design and color for each shingle removed. Depending on the age of the original shingle, colors may vary slightly, but natural aging will minimize the difference.
6. Reinstall the nails in the proper positions of the replacement shingles taking care not to lift the tabs of the remaining old shingles any higher than is necessary to hammer the nails flush.
7. Install replacement nails in the old overlying shingles where they were removed to permit the damaged shingles to be removed. Again use care when lifting overlying tabs.
8. Hand-seal all loosened tabs with an accepted asphalt adhesive.
9. **If waterproofing shingle underlayment, such as WinterGuard™ is under the shingles removed:** fill all nail holes with a **rubber-modified asphalt cement** such as Monsey "MB Roof Cement," Karnak "No. 81 Roof Cement," or equivalent. Do not use an excessive amount of cement. Use a putty knife to squeeze in only enough to fill the hole.

Acknowledgements

We wish to thank the following organizations for the material they make available which has been incorporated into this document:

- CertainTeed Corporation
  - CertainTeed's Shingle Applicator's Manual – Seventh Edition
  - CertainTeed's Shingle Technology Manual – Seventh Edition
- GAF Materials Corporation
- Owens Corning
- Tamko
- The National Roofing Contractors Association
- The Asphalt Roofing Manufacturers Association
- The Roofing Industry Committee on Weather Issues, Inc.

About Donan Engineering

Donan Engineering Co., Inc. is a forensic engineering and fire investigation company headquartered in Louisville, Kentucky with offices throughout the central United States. The firm conducts forensic investigations on several thousand commercial and residential roofs per year, and is routinely called upon by insurance companies, attorneys, manufacturers, contractors, and property owners for training and investigations on all types of roofs and structures.

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