"Shake-Style" Asphalt Shingles

Design Defect Prone to Hail Damage

By Dustin Smoot, RRC, RRO

When you are passionate about roofing and sustainability, as I am, it is difficult to watch roofs being replaced so frequently due to alleged damage from hail impacts. The research for this article began in 2013 when I first saw shake-style asphalt composition shingle roofs with hail damage. At this project, there were 47 multiunit structures on which one manufacturer's shake-style asphalt shingles had been installed. A moderate hailstorm had moved through the area with 1-in.-maximum-diameter hail and impacted these two-year-old roofs. At the time the roofs were installed, the owner had been sold a high-quality, "lifetime" roof and couldn't believe that the roof was damaged by the moderately sized hail.

After a lengthy review process, it was determined that there were on average three to five impacts per square (100 sq. ft.) that had damaged the shingle base mats and that were deemed unrepairable by two reputable roofing contractors. Interestingly, the damage was all located in similar areas on the shingles. The roofs were fully replaced, resulting in extensive waste and cost.

Since that time, I've seen many roofs with this same type of shingle damaged in the same way by moderate-sized hail impacts. Upon further investigation of this pattern, I found an industry-wide deficiency in the shape of shake-style shingles that makes them susceptible to even moderately sized hail.

SHAKE-STYLE ROOFING SHINGLES

These asphalt shingles were designed to simulate the look of cedar shingles or shakes. The advantages of this product are often stated as decreased maintenance, lower cost, and reduced fire hazard as compared to traditional cedar shakes/shingles.

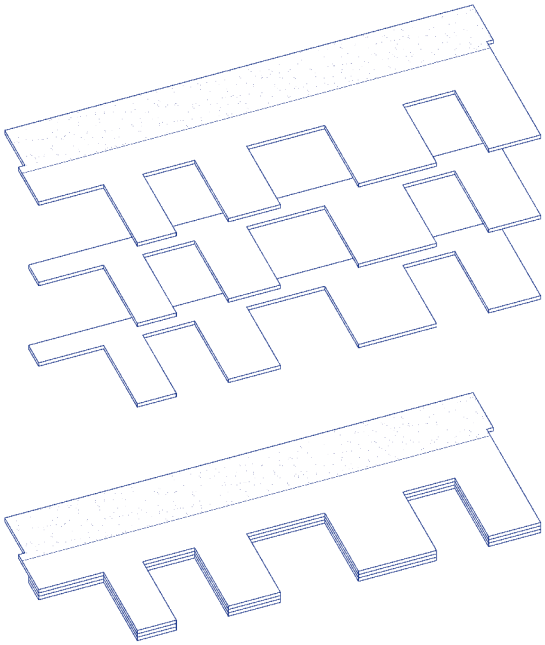

Figure 1 – Isometric view of shake-style shingle layers and assembled shake-style shingle.

Figure 2 – Visible, patterned hail damage at the notches of shake-style shingles.

Shake-style shingles start with a notched layer of an asphalt strip shingle, and one or two layers of appliqué are applied to the bottom side of the shingle notches to create a dimensional product with two or three layers (*Figure 1*).

As cedar is falling out of favor—particularly in areas like Colorado, where many municipalities have banned cedar shakes due to the danger posed by wildfires—these types of shingles have become very popular. Most, if not all, of the major asphalt shingle manufacturers began manufacturing shake-style asphalt shingles. They are usually marketed as a specialty, top-of-the-line shingle, including lifetime warranties, high-wind-speed warranties, and—in some cases—a Class 4 impact-resistant rating. A Class 4 shingle under the UL2218 standard requires that the product be tested by dropping a 2-in. steel ball on it from a height of 20 ft. and that it resist damage.

FIELD OBSERVATIONS

Several projects by multiple manufacturers across the country in which this style of shingle had been installed were observed with hail impact damage. Most of them had been installed within the last two years. Typically, hail within the ¾-in. to 1-in. diameter range had fallen on the properties. With a few exceptions, the impact damage that was observed was located within the notches of the shingles and not on the tabs of the shingles themselves. Refer to *Figures 2* and *3*, where the patterning of the hail impact damage is visible. Refer to *Figure 4*; the notches of

Figure 3 – Visible, patterned hail damage at the notches of shake-style shingles.

Figure 4 – Visible, patterned hail damage at the notches of shake-style shingles. Note notched areas were highlighted in red for clarity.

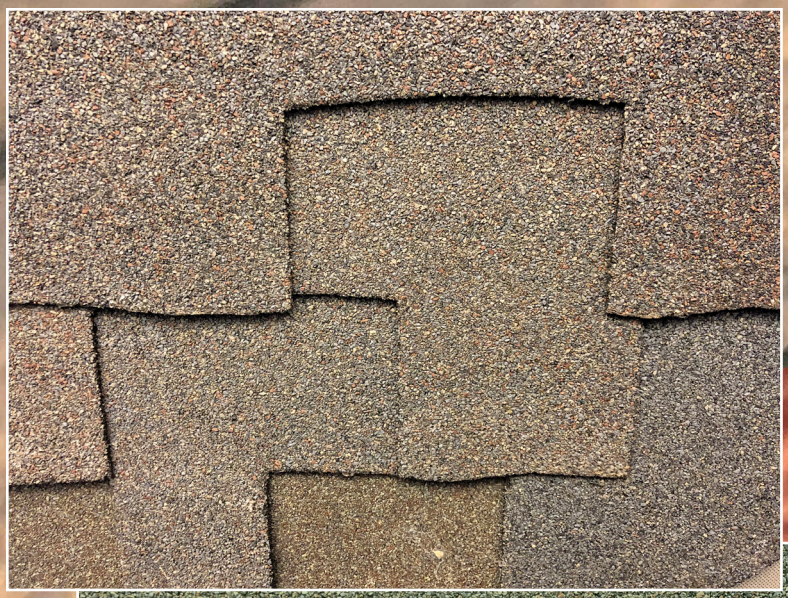

Figure 5 – Shingle view.

Figure 6 – Highlighted view.

the shingles have been highlighted to illustrate that there is impact damage in every notch, while no damage is present at the tabs.

ANALYSIS

As shown in *Figure 1*, the shingles were constructed with one or two additional layers of appliqué added to the bottom 6 to 8 in. of the shingle. However, at the notches, up to 10 in. of the underlying shingle is exposed. This exposes a section measuring 2 in. or more within the notches that is only one layer of strip shingle, with an abrupt edge of the underlying appliqué below. Refer to *Figure 5* for a photograph of a shingle view, and to *Figure 6* for the highlighted view. The green highlights are the areas with multiple layers of shingles—typically the lowest 6 to 8 in. of the shingles' exposure. The red highlights are the vulnerable areas, with only one layer of shingle material exposed.

Furthermore, because of the buildup of the appliqué on the underside of the shingle, it leaves the one-layer-thick area at the notches relatively unsupported. Refer to *Figure 7*, which shows a side view of properly installed shake-style shingles, demonstrating the unsupported, single-layer-thick areas that are vulnerable to damage from impact or traffic. The area near the bottom of the highlighted area in *Figure 7* is even more vulnerable due to the buildup immediately below. A noticeable void can be observed at this location, as indicated by an arrow in *Figure 7*.

A visual analysis was performed on five different brands of this shingle style, all of which were produced by major asphalt shingle roofing manufacturers. The observations were similar across all five product manufacturers. Some of the measurements vary between brands, but the unsupported, single-layer, exposed area was observed and similar in nature in all five manufacturers' products. This leaves this area more vulnerable to impact damage.

TESTING

Many of these shingles have been given a UL 2218 Class 4 impact resistance rating. Many shingles of this style have been listed as "approved" by insurance carriers to provide an option for property owners to achieve a reduced premium by installing a product that is less likely to be damaged.

While a full testing regimen was beyond the scope of this article, limited testing was completed using the steel ball drop test in general conformance with UL 2218 to confirm the hypothesis observed during field observations. The test evaluates the effect of impact from the steel ball at locations on the assembly selected to be most vulnerable, such as (but not limited to) edges, corners, unsupported sections, and joints. To meet the acceptance criteria of UL 2218, the roof covering material's exposed surface, back surface, and underneath layers must show no evidence of tearing, fracturing, cracking, splitting, rupture, crazing, or other evidence of opening of the roof covering layer.

As it was not feasible to test each manufacturer's product, a leading manufacturer's shingles were selected. This test was performed only to test the

Figure 7 – Side view of properly installed shake-style shingles, with single-layer, unsupported area shaded red and arrow pointing to "lip" created by the appliqué buildup below. This creates a condition susceptible to impact damage.

Figure 8 – Crack in the shingle after performing UL 2218 steel ball drop test.

theory that this single-layer exposed area was vulnerable to damage, not to provide an actual impact rating. A 2-in.-diameter steel ball was dropped from 20 ft. twice at each single-layer, unsupported, exposed area of the shingle sample. A clear crack in the shingle was observed on the top side of the shingle after the test, coincident with the ball impact location, as exhibited in *Figure 8*.

More testing should be completed by an independent testing agency to determine if these shingles meet the requirements set forth in UL 2218.

REPAIRABILITY

Returning to the case study at the beginning of this article, there are thousands of squares of roofs with limited damage of only a few hits in each square. With a more typical architectural laminated asphalt shingle, the observed amount of damage would have been most cost-effective to repair by replacing individual damaged shingles. However, the roofers who had evaluated the roofs with shake-style shingles claimed it was not practical to repair individual shingles, so we asked them to show us. We had roofers attempt to perform individual shingle replacement to hail-damaged shingles, and the following issues were observed:

- The glue strips on the tabs are very strong and difficult to separate, even when temperatures are cool. Separating them tended to cause more damage to the shingle than the hail had.
- The shingles typically come in different shapes to improve aesthetic appeal of the final installed roof. When replacing an individual shingle, the removed shingle must be replaced with the same shape of shingle. The bundles are not labeled with the shape of shingle that is in the bundle, which makes finding the right match difficult, especially on a large scale.
- Because of the "hinge" in the shingle between the thicker portion with the appliqués and the single-layer portion, the shingles tend to crack along this weak point.

Two separate repair contractors were asked to perform sample repairs. Both roofing contractors stated they would not be interested in performing the repairs due to the slow nature of the work, as well as the severe damage that was being done to the surrounding shingles, which then also had to be replaced. This resulted in full replacement of the roofs due to damage from moderately sized hail after being in place for only two years old, despite being covered with a supposedly impact-resistant lifetime shingle.

CONCLUSION

There is a need in the construction industry for more sustainable building products. As a society, higher-quality and longer-lasting roofing products are needed to reduce our impact on the environment and to better serve consumers, insurers, and the building industry as a whole. This type of roof shingle may be a great solution where hail is not a concern, but where hail is a regular occurrence, this shingle may increase the amount of waste that goes into the landfill when it is damaged.

Here in Colorado, many ownership groups and communities have required this style of shingles to be installed for a cohesive look in their neighborhoods. Insurance carriers are giving premium discounts for owners who install them on their property as a way to reduce the risk of a loss, but in this author's opinion, quite the opposite is occurring. It's our responsibility as specifiers and consumers to think critically about the products we are recommending to our clients as well as to educate them on what products to use in what application.

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Dustin Smoot manages the Denver branch of Terracon's Facility Group. His technical expertise includes forensic investigation and assessment of damage or failure caused by hail, wind, catastrophes, product failures, moisture infiltration/exfiltration (leaks or vapor drive), etc. He also specializes in providing building enclosure recommendations, plans and cost estimations for repairs, quality assurance observation, and peer reviews of construction documents with recommendations.