

A White Paper: Hail Damage to Composition Shingles

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Functional damage to any roofing is defined as diminution in its water-shedding capability or reduction in the expected long-term service life of the material. For asphalt or polymer-modified asphalt composition shingles, diminution in water-shedding capability is a fracture in the shingle. Impact-caused fractures initiate in regions of maximum tensile strain on bottom sides of shingles and propagate toward top sides (the granule surface). Hence, an impact-generated fracture always is detectable in the bottom side of a shingle. Fractures in bottom sides of composition shingles are accompanied by fractures in shingle reinforcements. These can be confirmed by de-saturating the shingle, extracting its reinforcement, and examining the reinforcement for fractures characteristic of impacts. As a hail-caused fracture is generated by the collision of a hailstone and the shingle, an impact with energy sufficient to fracture the shingle necessarily leaves an identifiable mark in the top surface of the shingle. Here, granules are dislodged and the shingle surface is dented inward. Our extensive field experience and laboratory impacting with simulated hailstones have confirmed that impact-caused damage is immediate and detectable visually and/or tactilely. An obvious fracture can be identified in the top surface of the shingle visually by unaided eye. In other instances, the fracture may not be obvious visually in the top surface of the shingle, but it can be felt with tips of thumbs or fingers as a localized soft spot. This regularly is referred to as a "bruise," as it feels like a bruise in an apple. A shingle bruise is a fracture (which can be identified visually



in the bottom surface of the shingle) and consequently does constitute damage to a composition shingle.

The expected long-term service life of an asphalt or polymer-modified asphalt composition shingle can be shortened when granules are dislodged sufficiently to expose the underlying coating bitumen to the weather. For shingles in relatively good condition with remaining service life, a hailstone capable of dislodging granules and exposing the coating bitumen necessarily fractures the reinforcement of the shingle and generates a detectable bruise. Importantly, when a shingle is struck by a hailstone dislodging granules and exposing coating bitumen while the underlying reinforcement remains intact, the shingle necessarily must be defective or else is nearing or has exceeded its expected service life. Consider a shingle whose granules and coating bitumen are flaking from the underlying reinforcement. When struck by even small hailstones, flakes of granules and coating bitumen can be dislodged and removed such that the coating bitumen no longer remains protected by the granules even though the reinforcement remains intact. Consider blisters in the coating bitumen. When struck by even small hailstones, crusts of granules forming the blisters can be broken away and similarly, the coating bitumen no longer is protected by the granules. If shingles are aged to the point that they no longer have any remaining service life, or if they are defectively manufactured, they have no value. Hail falling on a roof with no value, therefore, cannot cause functional damage.

The discussion of hail-caused damage to composition shingles must necessarily address the nuance of chips in butts and edges of shingles. A hailstone which strikes and crushes or breaks the butt or



edge of a composition shingle, usually causing a semi-circular shape, can constitute functional damage in some instances. First, the shingle is damaged when the hail-caused chip exposes features such as end joints between shingles, areas which cannot shed water. Second, the shingle is damaged when the hailstone-caused chip exposes materials not protected from the elements by protective surfacing, the granules. Conversely, hail-caused chips in butts or edges of shingles that reveal features which do shed water or expose underlying shingle areas covered by protective surfacing do not constitute functional hail-caused damage.

Many aberrations found in granule coatings on composition shingles are unrelated to hailstones. These include manufacturing deficiencies; mechanical damage including that which happens during application, maintenance, or intentionally; and natural weathering.

In summary, asphalt and polymer-modified asphalt composition shingles can be damaged by hailstones which fracture them. The damage is immediate and detectable visibly and/or tactilely in the top surfaces of the shingles. Regardless, the hail-caused fracture always is visible in the bottom surface of the shingle as well as in its extracted reinforcement. Based on the results of more than forty years of laboratory impact testing and natural weathering of composition shingles, we have determined that granule loss from a location struck by a simulated hailstone that did not fracture the reinforcement, did not affect the shingle service life.