# Hail Damage 101

by *Michael Hayes, P.E., Structural Engineer*

Every year, hail damages or destroys homes, aircraft, cars, crops and can even be fatal to livestock. In 2010 The Bureau of Labor Statistics cited over one billion dollars in damage caused by hail in the United States. In the last 10 years, hailstorms have caused over 3 billion in
insured damages in Colorado alone. With so much money paid out in hail damage cases, fraudulent hail damage claims are becoming more prevalent, and in some instances, harder to detect. In this article I will address what hail is, and the damages it can cause to houses, specifi-cally composition or asphalt roofs. I will also address damages caused by mechanical forces or impostor/fraudulent hail damage.

What is hail and how is it formed? According to the National Oceanic and Atmospheric Administration (NOAA), hail is precipitation that is formed when updrafts in thunderstorms carry raindrops upward into extremely cold areas of the atmosphere causing them to freeze. The raindrops form into small frozen droplets and then continue to grow as they come into contact with super-cooled water which will freeze on contact with the frozen rain droplet. This frozen rain droplet can continue to grow and form hail. As long as the updraft forces can support or suspend the weight of the hailstone, hail can continue to grow.

At the time when the updraft can no longer support the hailstone, it will fall down to the earth. For example, a ¼" diameter or pea sized hail requires updrafts of 24 mph, while a 2 ¾" diameter or baseball sized hail requires an updraft of 81 mph. The largest hailstone recorded in the United States was found in Vivian, South Dakota on July 23, 2010, measuring eight inches in diameter, almost the size of a soccer ball. Thankfully soccer-ball-sized hail is the exception, but even small pea sized hail can do significant damage.

Colorado's hail season is from mid-April through mid-August. With Colorado's Front Range located in "Hail Alley," Coloradans are no strangers to hail storms. On average, Colorado's Front Range experiences three or four catastrophic (defined as at least $25 million in insured damage) hailstorms each year. With major hail events each year and little that can be done to prevent hail damage, insurance companies are finding hail damage is becoming more and more costly each year. It is more important than ever to be able to discern between actual hail damage and impostor hail damage.

Asphalt shingles are the most commonly used residential roofing material because they are easy to work with; they work well in most climates and are relatively inexpensive. Asphalt shingles are fabricated from three pieces: the reinforcement or mat, most commonly made from fiberglass; the waterproof binder made of asphalt; and the wearing surface made from crushed stone which serves to protect the binder, reflect heat, add color and provide fire resistance.

Asphalt shingles will age naturally when exposed to the elements and become brittle as they age. In many cases, the asphalt shingles will deteriorate faster due to manufacturer or installation defects, and these types of defects should never be ruled-out when performing an assessment of an asphalt roof.

When assessing a roof with potential hail damage, a lot of information can be gathered before ever climbing onto the roof. There are many useful websites that can help determine if there was a hail-producing storm on a specific date, and if so, the size of the hail produced by the storm and the direction the storm was moving. This is a simple way to verify the kind of damage that might be expected.

Another simple step, if possible, is to talk to neighbors. Many times if one person is reporting hail, there are likely other claims filed by neighboring homeowners, assuming there is a neighbor within a relatively close proximity to the reported house. Walk the site – hail damage is not exclusive to roofs. If the event is recent, you should see downed tree branches and flower beds that have been dam-aged. If the event is not as recent, you should still be able to see damage to fences, dents in metal flashing, air conditioning units, mailboxes, BBQ grills, hot tub covers, and cars.

From these indicators around the house, you can start to form a theory as to the size of the hailstones and the direction of the hail impacts. These indicators should be consistent with the neighbor's house and information reported by the weather agency. The damage found around the structure should also be consistent with the damage found on the roof. It is important to note that dents in many surfaces, specifically metals, are permanent and can accumulate hail damage over time, so be careful not to assume that the damage you see is from the reported weather event.

Hail is wind-driven, so not each side of the roof is going to be damaged equally. Hail that impacts a roof perpendicularly will cause greater damage than hail that impacts at an angle. Therefore, you are more likely to see major damage to the wind-ward side than the leeward side of a roof. It follows that if you have multiple sections of roof fac-ing the same direction, you should see equal amounts of damage to all roofs facing the same direction. The windward face is not always the west facing side. Large rotating storms can have an east to west movement. In these types of storms, the wind and hail can come from the east.

Each individual hailstone can vary in size, shape and hardness, and although they are generally rounded, they are not perfectly round and the damage they cause should be random. The major damage caused by the hailstones should be randomly distributed across the windward facing roof. It is not likely to find a localized area where there is major damage when just feet away on the same face, there is no hail damage.

The damage caused by hail can be described as "wound" like; similar to when a person is wounded and the skin has been broken. A shingle can be "wounded" by a hailstone, the granule surface gets scraped off and the asphalt binder is exposed. For recent hail damage, the asphalt will still look black and fresh. Hailstones that hit with greater impact

may actually puncture the fiberglass reinforcement. If the fracture or puncture is visible in the bottom surface of the shingle, the water-shedding capability of the shingle has been damaged and the expected service life of the shingle has been compromised. If the “wound” is significant enough to damage the fiberglass reinforcement, then the composite shingle needs replaced at that time. Granular loss from a hailstone that does not fracture the fiberglass reinforcement does not need replacement and does not generally reduce the life expectancy of a shingle. If extensive granule loss is found in gutters and downspouts, it may be an indication of a manufacturing issue or weathering anomalies.

It is important to be able to recognize impostor hail damage. Impostor hail damage can be defined as intentional mechanical damage purposefully done to fraudulently represent hail damage. There are usually clear indications the damage is impostor hail. Impostor hail damage can have a defined pattern. The damage pat-tern may be a specific shape like a line or arch, or a sequence like every other shingle.

Impostor hail damage will be uniform in shape and in size. Some type of instrument (ball peen hammer, screwdriver, BB gun) was used to make the damage and each mark will have a clearly defined similar impression.

Steep areas and areas along the edge of the roof are void of any damage of impostor hail damaged roofs. These areas are just too difficult to reach. You will also not find any damage around the structure in the initial evaluation; the mailbox, fence, BBQ and air conditioning units are all free of any damage or indications of hail.

It is also important to check your weather notes. Is the storm direction consistent with the damage? Does the reported hail size make sense with the size of the marks made? Is the damage random in size and pattern? Are there other indications of damage? If you answer no to most of these questions, then most likely you have impostor hail damage.

The following characteristics are typical of mechanically induced impacts with the intention to mimic hail damage:

- *Intentional damage is not randomly distributed. Normal hail damage is randomly distributed across the affected portion of the roof. Intentional damage tends to be singular, occurring once per shingle.*
- *Intentional damage often occurs in groups or lines across several shingles.*
- *Intentional damage is usually concentrated away from roof edges, as the person creating the damage is wary of falling from the edge of the roof.*
- *Impact angles are often nearly perpendicular to the affected roof slope.*
- *Mechanically induced impacts are often located at the interior, center areas of individual shingles. It is human nature to strike the center of an object.*

In many cases the damage done by hail is clear, but in some cases it is a bit more complicated and each type of roofing material (i.e. Asphalt, Tile, Wood Shake) has its own unique properties with its own unique problems. Phoenix can investigate your hail damaged roof promptly and will provide you with a clear, honest, un-biased conclusion regarding the most probable cause of the damage.

***References:***

*National Oceanic and Atmospheric Administration (NOAA) website:* NOAA - Thunderstorm Hazards, Hail *http://www.srh.noaa.gov/jetstream/tstorms/hail.htm*
*National Oceanic and Atmospheric Administration (NOAA) website: NOAA Economics – Extreme Events, Hail http://www.economics.noaa.gov/?goal=weather&file=events/hail*
*National Oceanic and Atmospheric Administration (NOAA) website: NOAA – Severe Weather Primer, Hail Basics http://www.nssl.noaa.gov/primer/hail/hail_basics.html*
*Rocky Mountain Insurance Information Association (RIMA) website: Hail http://www.rmiia.org/Catastrophes_and_Statistics/Hail.asp*
*Haag Engineering, Composition Roofs Damage Assessment Field Guide, Fifth Edition*