Mastering Roof Inspections: Hail Damage, Part 3

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The purpose of the series "Mastering Roof Inspections" is to teach home inspectors, as well as insurance and roofing professionals, how to recognize proper and improper conditions while inspecting steep-slope, residential roofs. This series covers roof framing, roofing materials, the attic, and the conditions that affect the roofing materials and components, including wind and hail.

HAIL DAMAGE CHARACTERISTICS

Let's take a look at the different factors which determine how severe hail damage can be.

Hail damage has certain characteristics which vary with both the different properties of hail, and with the properties of the various roofing materials that hail hits. First, let's examine the different properties of hail.

The severity and appearance of the damage caused by hailstones depends on a number of variables. The size, density, free-fall velocity, the shape of the hail, its directionality, and angle of impact can all affect the damage you see during an inspection.

IMPACT ENERGY

Three of these properties -- size, density, and free-fall velocity -- affect what's referred to as the "impact energy" of hail. Impact energy is the amount of energy transferred to the roof-covering material when the hailstone strikes. Impact energy is *the most important factor* influencing the severity of damage caused by a hailstone. A hailstone carrying a lot of impact energy will do more damage than one carrying less impact energy.

Size

Size is an important factor because larger hailstones are heavier and fall faster than smaller hailstones, and so they carry more impact energy.

Natrional Center for Atmospheric Research

The largest hailstone ever recorded in North America fell in Aurora, Nebraska in 2006.

Hail size is described by comparing it to a common object. Here are some commonly used descriptions:

- pea = 1/4-inch in diameter;
- marble = 1/2-inch in diameter;
- dime or penny = 3/4-inch in diameter (hail the size of a penny or larger is considered severe);
- nickel = 7/8-inch;
- quarter = 1 inch;
- golf Ball = 1½ inches;
- tennis Ball = 2½ inches;
- baseball = 2¾ inches;
- tea cup = 3 inches; and
- grapefruit = 4 inches.

TABLE 1

Material	Hail Size	Damage Size
3-tab organic shingles	1-inch	25mm
3-tab fiberglass shingles	1¼-inch	32mm
cedar shingles	1¼-inch	1¼-inch

fiber-cement tiles	1¼-inch	1¼-inch
flat concrete tiles	1¼-inch	1¼-inch
heavy cedar shakes	1½-inch	38mm
30-year laminated shingles	1½-inch	1½-inch
built-up gravel roofing	2-inch	50mm
S-shaped concrete tiles	2-inch	2-inch

Table 1 shows the size of a hailstone typically required to damage various types of roof-covering materials. This is a general guide only, since the severity, appearance and likelihood of hail damage can be affected by a number of factors.

You can see that organic 3-tab shingles are the most fragile, since they can sometimes be damaged by hail as small as 1 inch in diameter.
Three-tab fiberglass, cedar shingles, fiber cement, and flat concrete tiles may begin to suffer damage when hail reaches about 1¼-inch in diameter.

Heavy wood shakes and thicker fiberglass shingles may start showing damage when hail reaches about an 1½-inch.

Concrete S-tiles can start showing damage when hail reaches about 2 inches.

The size of a hailstone is determined by the number of ice layers it accumulates before it falls to the earth. Larger, more powerful storms with strong winds may keep hailstones aloft long enough for them to reach large sizes.

It can be difficult to tell the size of a hailstone by the damage it leaves.

Damage left by hailstones of the same size can vary, depending on the hailstones' density, their angle of impact, and the properties of the material they hit.

It's also common for the size of hailstones to vary within a single storm. Hailstones at the leading and trailing edges of storms may be of a size different from those in the main body of the storm, so it's not unusual to see damage to a property with characteristics of different sizes of hailstones.

When discussing the importance of impact energy and the characteristics of hailstones, size is the easiest to estimate. You can't tell the density or free-fall velocity of a hailstone by looking at the damage it leaves behind. But as you become more experienced at

inspecting hail damage, you'll become more skillful at judging the size of the hailstone by looking at the damage to a variety of materials.

Hard hailstones hitting soft, thin materials, such as aluminum vents, will leave a better indication of their diameter than soft hailstones hitting hard materials.

You don't really need to determine the actual size of the hailstone. Your mission is to identify functional damage, or the lack of damage. Size is just one more clue.

Larger hailstones tend to be less spherical. They often grow not only by gaining ice layers, but also by colliding and merging with other hailstones.

National Center for Atmospheric Research

As hailstones collide, they can form odd, asymmetrical shapes, as you can see here. Each of these lobes was once an individual hailstone.

Although recognizing damage from huge hailstones is easy, recognizing what is and isn't damage from smaller, softer hail can be much more difficult.

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