

Assessment of Hail Damage on Low-Slope Bituminous Roof Systems



By Justin Reeder, RRO, PE; and Keith Parker, RRC, RRO, CDT

Ovious statement of the day: Hail can damage low-slope bituminous roofs, whether modified bitumen or BUR; asphalt or coal tar; smooth, granule-, or gravel-surfaced. According to FM Global, more than 1,000 hail claims were made between 1998 and 2008, with losses exceeding \$300 million.¹ Knowing that hail damage can often be overlooked, this article is intended to help those who may not be as familiar with hail investigations, particularly on low-slope bituminous membrane roofs.

First, as with any low-slope roof hail investigation, do not focus solely on the roof membrane or surfacing. Observing the conditions of the surrounding components of the roof can provide good insight into characteristics of the hail-producing thunderstorm. Examination of metal flashings, exhaust fans, windows, HVAC evaporator fins, etc. can help determine the intensity, direction, and size of the hailstones generated. Often, blue tarpaulins decorating adjacent buildings' roofs can be an indicator of storm direction and severity.

Believe it or not, sites like YouTube can be good tools as well. If

the storm was strong enough to damage the roof, in today's age of information, chances are someone has posted a video of it online. Additional information about the thunder-

storm and hailstones can often be gathered from these eyewitness videos. (Disclaimer: As always, take everything you see on the Internet with a grain of salt. YouTube is



Photo 1 – Complete fracture of low-slope bituminous roof membrane from hail strikes. Membrane was installed over fiberglass board insulation, a less-dense coverboard in comparison to a gypsum substrate.



Photo 2 – Unsupported modified-bituminous flashing membrane and resulting hole from hail strike. Note: Gravel-surfaced BUR was otherwise undamaged from the hail.

not part of the scientific method; don't treat it as such.) Often, accurate and real-time information can be provided via weather data centers. Detailed information with forensic analysis of the hail-producing thunderstorm can also be ascertained from these sources.

In addition to size and velocity of the hailstones, several other factors can influence the extent of damage to the low-slope bituminous roof system. On a newer roof, the system can generally be more forgiving to hail strikes. Experience has found that the bitumen is less likely to fracture,

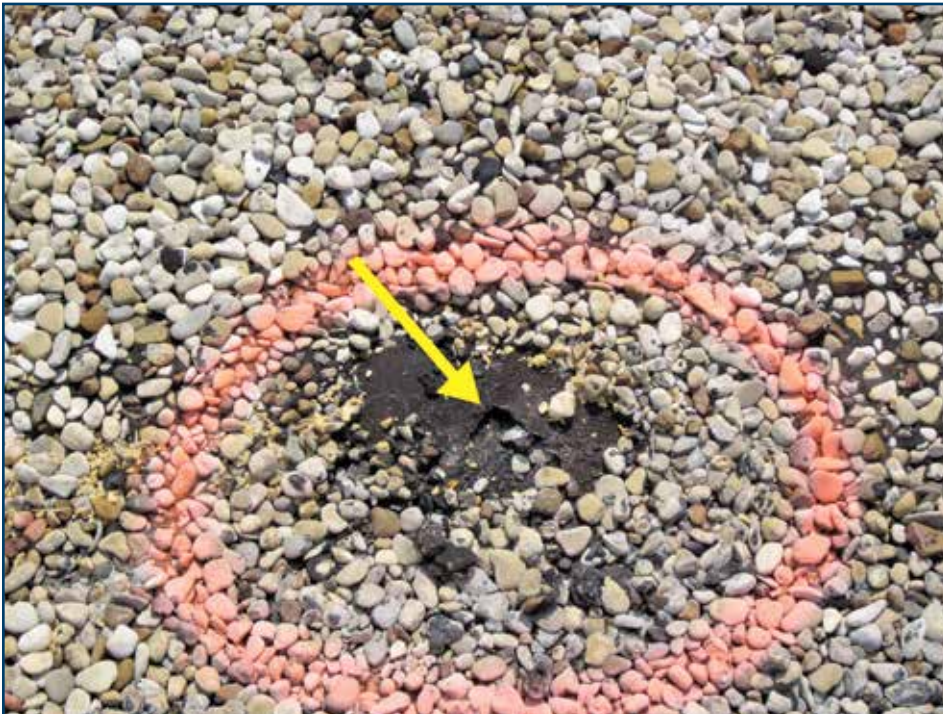


Photo 3 – Blister observed in a coal-tar pitch roof. A “lucky” hail strike right on target left this system with a reasonably sized hole.

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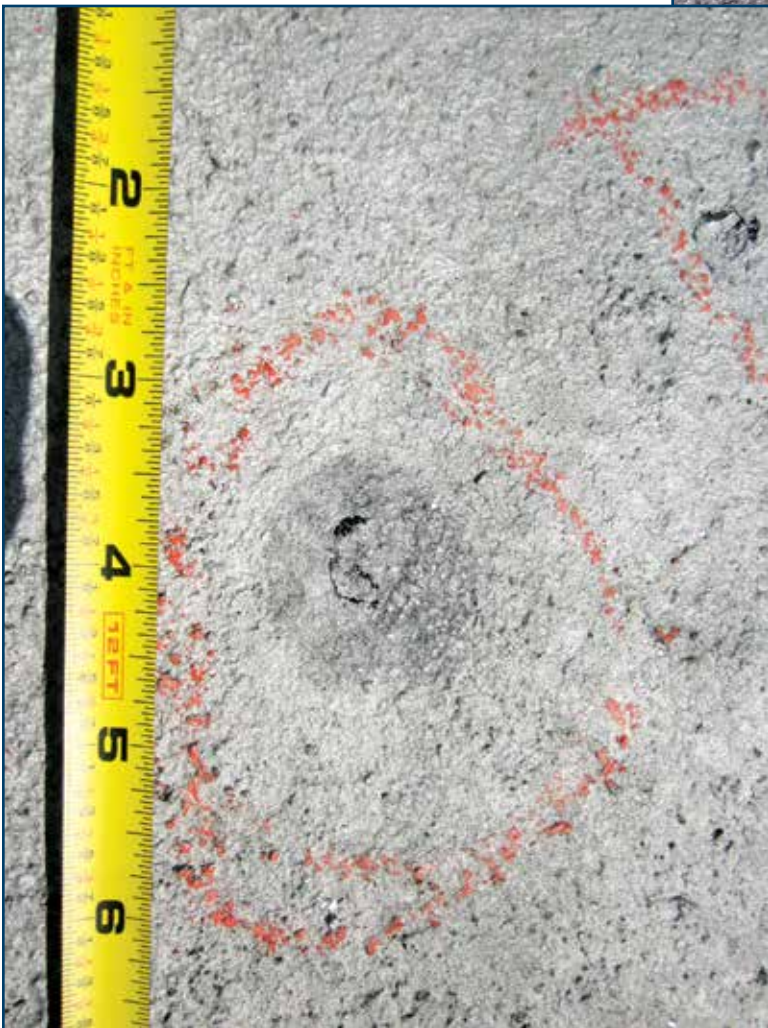
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Photo 4 – Overview of hail strikes on a granule-surfaced cap sheet. The two worst hail strikes are circled. Each showed granule loss and felt soft or “bruised.” The additional white marks are also hail strikes, but not as severe. Removal of the oxides from the granules leaves a clean spot or “splash mark.”



Photo 5 – Fracture in a coated, granule-surfaced cap sheet. Note wicking of moisture from within membrane plies.



which means water is not immediately entering the system. In this case, with no active leaks resulting from the hail, an owner may not even realize his or her roof has been damaged. However, the reinforcement mat of the membrane could be damaged from the hail’s impact, leading to shortened life expectancy of the roof membrane while it still may be acting as a fully functional watertight barrier.

The older the roof, the more brittle it can be due to long-term environmental exposure. With this being the case, one can expect to see more fractures of the bitumen due to hail strikes in older roofs. Ruptured bitumen can allow water to enter the roof membrane or, potentially, the insulation system.

Substrate plays an important role in defense of hail strike damage on low-slope bituminous roofs. Typically, a denser cover board (such as gypsum) over the insulation system will provide a better resistance to hail. The softer the substrate, the more the membrane can be moved or displaced as a result of the hail strike. This allows for increased chances of a fracture in the reinforcement mat or scrim and even the entire membrane itself. For example, a granulated cap sheet installed over fiberglass insulation boards was completely fractured during a recent hailstorm in Texas.

Just because the field of the roof seems to be unaffected by hail, don’t write your report just yet. The next places to investigate are the base flashings. In locations of bridging or

unsupported areas of membrane, susceptibility to hail damage is increased. Damage observed at these locations can be as obvious as a full fracture of the membrane or as subtle as displaced granules. As previously stated, the membrane reinforcement mat could be damaged but still acting as a watertight barrier, with the only clue being some subtle granule displacement.

At first glance, a gravel-surfaced, built-up roof (consisting of asphalt or coal tar) may be assumed to not have hail damage. Most appear to fare better in comparison to adjacent modified-bituminous membranes following a hail-producing thunderstorm. This may be true, but the roof should be thoroughly inspected for any blisters, exposed felts, or areas of thinned gravel or bitumen in addition to unsupported base flashings. These built-up roof deficiencies can be easily overlooked during the inspection process, especially amidst large-scale or fast-paced investigations. With this in mind, take your time and formulate your own pace for the inspection. Many times, these types of examinations are conducted in the presence of other individuals with

mixed expectations. Our advice is to work at one's own pace and establish the goal of the investigation up front with all parties, including the fact that conclusions may or may not be established that day.

SO, WHAT IS THE EXTENT OF THE DAMAGE?

Quantifying the damage discovered during the investigation can be done in a few different ways. One is to visually inspect the surface of the membrane or felts. Look for displaced, embedded, or crushed surfacing. Also, look for displaced bitumen or exposed membrane scrim. This may be easier to see on a granule-surfaced modified-bitumen sheet than on a gravel-surfaced built-up roof. Note the frequency of the hail strikes by measuring out a few "test" squares (10 x 10-ft. areas), and count the number of strikes within each area. If these are similar to the pattern noted throughout the roof, the results can be extrapolated appropriately.

Another approach is to perform test cuts of the bituminous roof membrane. Locate a few areas containing hail strikes

typical of the sampling area, and remove a 12 x 12-in. segment of roof membrane. (Note: Cutting depth should be adequate to ensure recovery of all roofing layers/plies and not the underlying insulation.) Visually inspect the backside of the sample. The membrane(s) or plies will likely come out in one piece if fully adhered. If so, do not try to separate them. Instead, inspect for any visible fractures or ruptures of the bitumen or membrane. Keep in mind that displacement may be present yet only observable under magnification. Examine the insulation and membrane for the presence of moisture and impact marks. The use of an electrical-resistance moisture meter with probes is recommended.

Additional information regarding the extent of damaged areas can be obtained through a laboratory analysis of the sample. If no damage has been visually observed, the only way to conclusively tell if the membrane reinforcement is broken is by way of desaturation analysis. This process involves submerging the membrane segment in a solvent and allowing the bitumen to dissolve away, leaving only the reinforcement scrim.

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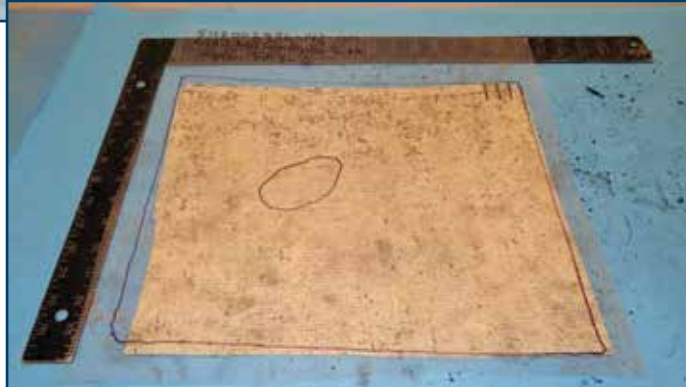


Following this process, the mat or scrim can easily be inspected for fractures. The lab should locate, mark, and document the damaged areas with photos before and after the desaturation procedure.

Now that you know the membrane is damaged, should it be repaired or replaced? Several variables can affect one's recommendation, such as roof system construction/age/condition, roof warranty, the owner's needs, insurance policy requirements, etc. For example, one well-known insurance company revised its roof coverage policy starting October 1, 2012, to include 25% to 100% of the roofing material based on actual cash value in lieu of the previous roof coverage inclusive of all roofing materials, regardless of age.² If the damaged roof in question falls under this revised policy, greater consideration in regard to age and condition will be required.

As an illustration of variables affecting a recommendation, a three-ply built-up roof with a modified-bituminous cap sheet that was nearing the end of its life had been coated, patched, and repaired multiple times prior to being damaged by hail. The roof already had existing blisters and water trapped under some of the repairs. Hail fractured the membrane reinforcement and the cap

Photos 6A and 6B – A modified-bitumen roof membrane before and after desaturation.



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sheet, but it did not do enough damage to allow water into the insulation system. The owner had this roof scheduled for replacement within three years. Because of the existing condition and the owner's needs, they settled with the insurance company and put an additional coating over the roof to extend the service life of the system to the scheduled replacement date.

In a different case, a two-ply modified-bitumen roof, early in its life and in good condition, was damaged by hail. Strikes were evidenced by dislodged granules and, in the worst locations, some bruising of the membrane. The waterproofing integrity of the system was not immediately compromised. Test-cut samples of the roof were taken, and upon further analysis, determination was made that the reinforcement of the membrane was fractured in the previously indicated worst locations of observed hail-strike damage. Intuition said total replacement of the system seemed extreme and that a manufacturer-approved

and warranted re-cover could be sufficient, but due to the policy's wording, the insurance company had to completely replace the roof in order to return the system to its original condition.

As with most things, the answer isn't always black or white; it lies in the best judgment of the professional. Research and field experience are important. Understand the objectives of the client up front, and proceed with confidence and impartiality. Remember that conclusions don't have to be made while still on the roof. 

REFERENCES

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2. Farm Bureau Insurance, Tennessee. "About Changes in Our Roof Coverage," November 1, 2012. www.fbitn.com/home-insurance/property-insurance-faq/2356-about-changes-in-our-roof-coverage.

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Church to "Pay Forward" After Roof Repair Donation

Members of the Hoboken Presbyterian Church in Blawnox, PA, will be looking to do some good deeds in the new year. Church officials have promised to "pay it forward" after getting a break on the cost of roof repairs to their church.

Finances have been tight for the church. To make the repairs needed for insurance reasons, members turned to Welte Roofing for help. Officials of the roofing company agreed to reduce the price of the repairs in exchange for the church doing some good for others.

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