Insurance Institute for Business & Home Safety®

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IBHS Hailstorm Demonstration Results

Insights on Recreating a Hailstorm

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On February 20, 2013, the Insurance Institute for Business & Home Safety (IBHS) took a great stride forward in their unique, multi-faceted hail research program. Years of planning and conducting field and smaller laboratory work paid off as scientists and technicians were able to meticulously recreate a full-scale hailstorm in the IBHS Research Center's large test chamber.

It is important to note that this impressive, first-ever indoor hailstorm was a capabilities demonstration for member company representatives, roofing and building industry representatives, and media organizations. While it was informative, further foundational work is required before IBHS can undertake the type of research program that will yield actionable data for IBHS members and other interested parties. When fully functional, IBHS' long-term hail research initiative will help those who manage and evaluate different hail-related risks by:

- investigating the impact of aging on building material performance when subjected to hail impacts;
- documenting differences between cosmetic and structural/functional damage – and provide insights and guidance about best practices when it comes to evaluating, as well as repairing and replacing building components exposed to hail;
- evaluating current standardized testing methods for roof cover; and,
- establishing standardized test methods for siding and fenestration/glazing, since no standards exist for these items.

In order to quickly advance this ambitious agenda, IBHS will use their highly realistic fabricated hailstones and deployment system for impact testing in the Institute's smaller hail lab. The scientists also will be working to perfect the methodology used for future full-scale, large test chamber hail research. This will include:

- automating the production of artificial hailstones to improve the ability to repeatedly run tests over a short period of time;
- automating the process for loading hailstones into the hail cannons, so that a smooth firing sequence is achieved; and,
- synchronizing the fans with the hail cannons so they work in concert with each other.

In addition, as these technological challenges are being resolved, IBHS scientists will continue to conduct field research during the spring storm seasons to gather more real world data on the compressive strength or hardness of hailstones, to inform laboratory projects.

IBHS Hailstorm Demonstration Details

Researchers created more than 9,000 highly realistic hailstones (with diameters of 1", 1.5" and 2") using a mixture of tap water and seltzer water to attain the appropriate size, density and hardness that closely mimic real hailstones. IBHS researchers also designed and built multi-barreled hail cannons, which delivered the hailstones at up to 76 miles per hour on to a 20 ft. by 30 ft. residential-style structure which featured different types of roofing and siding materials.

Overall findings:

- IBHS was able to closely mimic hail conditions present in a typical supercell thunderstorm that produces hail.
- The majority of hailstone impacts were on the roofing system; this is very typical of what IBHS researchers have seen when conducting post-hailstorm damage investigations in the field and in numerous claims studies.

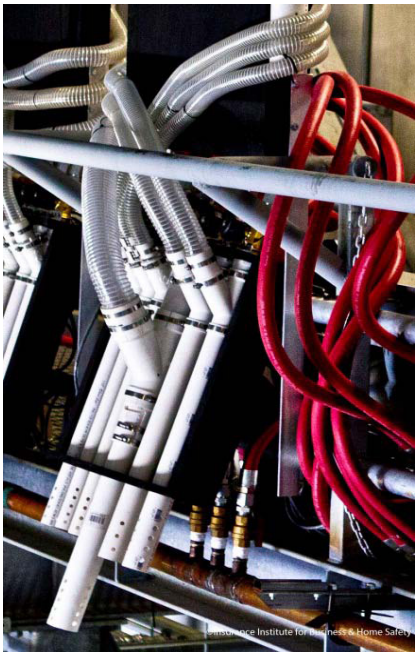
- The hail delivery system developed by IBHS successfully propelled hailstones at the correct terminal velocity for each size of hailstone.
- Post-test damage surveys revealed roof damage patterns consistent with what IBHS researchers documented in the field following recent hailstorms in Colorado and Texas.

About the hailstones and propulsion system:

- More than 9,000 hailstones were launched during the test.
- 1-inch hailstones traveled at 51 mph.
- 1.5-inch hailstones traveled at 63 mph.
- 2-inch hailstones traveled at 76 mph.
- The propulsion system, which used an automated control system to ensure proper distribution of variously sized hailstones across the storm field, included 12 cannons, each with six barrels.

About the test specimen:

- One-quarter of the roof was covered with standard 3-tab asphalt shingles installed directly over a plywood deck.
- One-quarter of the roof was covered with impact resistant laminate asphalt shingles installed directly over a plywood deck.
- One-quarter of the roof was covered with standing-seam metal installed directly over a plywood deck.
- One-quarter of the roof was covered with standing-seam metal installed over a layer of 3-tab asphalt shingles.
- Aluminum rain gutters were installed at each eave.
- All products on the building were new and recently installed.



A hail propulsion system is shown attached to the IBHS Research Center catwalk 60 ft. above the test chamber floor. During the demonstration, hail was loaded into 12 cannons, each with six barrels able to deliver variously sized hailstones.

Damage patterns:

Overall, the impact patterns were random in nature. This is representative of what has been witnessed in nature during post-hailstorm damage investigations by IBHS researchers.

Aluminum Gutters:

- Numerous large dents were observed on the gutters, decreasing their effectiveness, and (in the real world) reducing curb appeal.

Damage to the test specimen's aluminum gutters.

Asphalt Shingles:

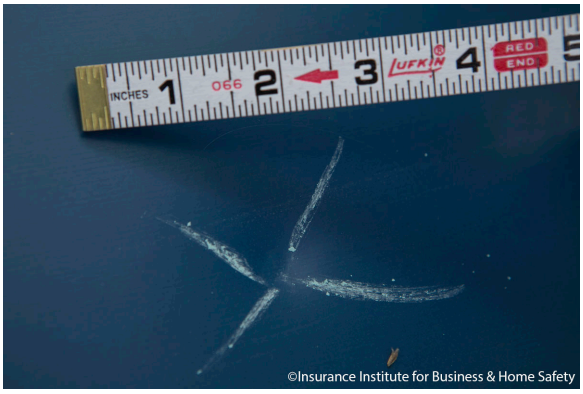
- Impact-resistant shingles: the majority of impacts were cosmetic. A few impacts did puncture the shingles, causing functional damage.
- 3-tab shingles: the majority of the impacts were severe enough to be considered functional, rather than cosmetic, damage. A few cosmetic marks also were observed.
- Opportunity for further study: The cosmetic impact marks should be monitored to determine if they will lead to further shingle degradation, which would reduce the life of the roof and increase vulnerability to water entry.

An impact is shown on one of the test specimen's impact-resistant laminate shingles. The majority of impacts on these shingles were only cosmetic.

Damage is shown to a 3-tab shingle on the test specimen. The majority of impacts on these shingles were severe enough to be considered functional damage.

Metal Roof:

- Damage to both sections of metal roofing was cosmetic in nature, leaving visible dents but no punctures.
- Standard installation of metal over roof deck: dents were smaller and shallower.
- Metal installed over shingles: dents were larger and deeper.



Although the damage to the test specimen's metal roof shown above is clearly visible, it was only cosmetic in nature.

Recreating Mother Nature inside the IBHS Research Center requires creativity, scientific curiosity and patience. From making the hailstones to building the delivery system for the hailstones, IBHS engineers have been working since 2010 to develop the test protocol and customized equipment that now enables scientists to conduct full-scale hail testing. It has been an arduous task with many challenges, and IBHS staff is very pleased that the threshold has been crossed to conduct this unique research, which will ultimately lead to safer, stronger communities. ◆

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