From Concept to Reality: The First-Ever Indoor Hailstorm

Recreating Mother Nature inside the IBHS Research Center requires creativity, scientific curiosity and patience. IBHS will make history today, demonstrating innovative leadership in building science and property damage prevention, by conducting the first-ever full-scale hailstorm in an indoor, controlled laboratory setting. From making the hailstones to building the delivery system for the hailstones, IBHS engineers have been working since 2010 to develop a test demonstration protocol and customized equipment that will lead to an enhanced understanding of the real-world effects of hailstorms.

MEASURING HAILSTONES IN THE FIELD

Among the challenges facing IBHS researchers is the fact that – unlike size and density – there is no standard definition or measure for the compressive strength, or hardness, of hailstones. While it is logical that harder hailstones will cause more damage, that hypothesis must be explored. To do that, IBHS had to create a compressive force device that was portable enough to take into the field to measure actual hailstones.

Research Center staff used a load cell (like those found in bathroom scales), a vice, and a balance to measure hailstone mass, and a caliper to measure stone dimensions. The vice was customized to include the load cell and was interfaced with a complex computer program to measure compressive force needed to crush different hailstones; they combined this data with GPS information about the location of where each hailstone fell in order to tie hail characteristics back to specific storm attributes.

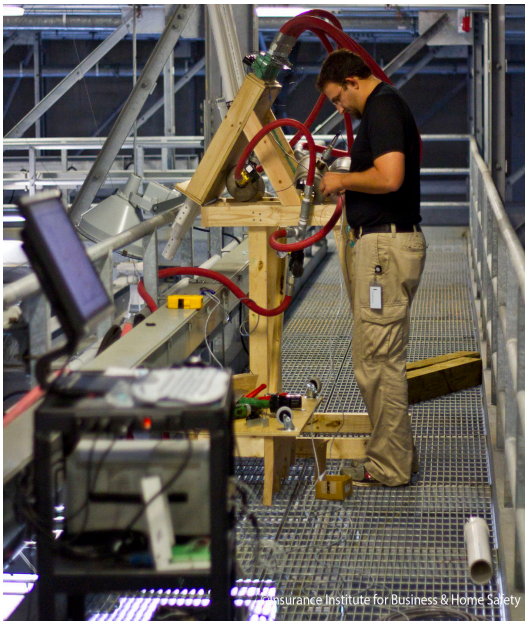
Dr. Tanya Brown, IBHS research engineer, examines hail collected in the field.

MANUFACTURING REALISTIC HAILSTONES IN THE LAB

Among the many unique aspects of the IBHS hailstorm is the use of thousands of very highly realistic hailstones, which are painstakingly created by IBHS scientists. A mixture of tap water and seltzer water is used to attain the appropriate shape, density and hardness that closely mimics hailstones produced during real storms. This laboratory work is based on, and supplemented by, field research. The IBHS team spent seven days in 2012 gathering extensive data from hailstones produced by nine separate storms in six states, which was used to develop the hand-made hailstones in the laboratory.

CREATING A HAIL DELIVERY SYSTEM

Another distinctive aspect of IBHS laboratory work involved creating an effective system to properly deliver hailstones. After investigating numerous options, IBHS researchers determined there was no off-the-shelf solution. IBHS engineers designed and built multi-barreled hail cannons, which are mounted on the Research Center catwalk, 60 feet above the test specimen house inside the center's massive test chamber.



Dr. Ian Giammanco, IBHS research scientist, works on a hail cannon on the IBHS Research Center catwalk.

ABOUT THE TEST DEMONSTRATION

During the full-scale IBHS hailstorm, multi-barreled hail cannons will deliver approximately 8,000 to 10,000 hailstones (with diameters of 1", 1.5" and 2") at up to 76 miles per hour. The cannons are aimed a 20 ft. by 20 ft. residential-style test specimen featuring different types of roofing and siding materials. In the first-ever demonstration of this capability, to simulate a common residential space, a car and typical outdoor furniture, toys, and accessories are placed near the structure.

The full-scale test specimen features a variety of building materials to allow for comparisons of performance:

ROOF

- One plane of the roof is covered with standard, non-impact-resistant, 3-tab asphalt shingles.
- Another plane is covered with impact-resistant architectural shingles, which have been tested in a laboratory to withstand the impact of a 2 inch steel ball dropped from a height of 20 feet in accordance with the UL 2218 test standard.
- The other two planes of the roof are covered with standing seam metal roofing. In one case, the metal roofing is installed directly over the rood deck; in the other case, the metal roofing is installed over a layer of asphalt shingles – a common real world occurrence and one which may result in more hail damage.

EXTERIOR WALLS

- Two sides are covered in fiber-cement siding.
- The other two sides feature standard vinyl siding.

WINDOWS

- Both vinyl and aluminum windows are installed.

GUTTERS

- Both aluminum gutters and downspouts are installed.

IBHS' HAIL RESEARCH INITIATIVE

Today's test is an example of the robust, multi-variant feedback loop IBHS has created between its field research and laboratory research. Creating a full-scale indoor hailstorm enables IBHS researchers to conduct a multi-year hail research initiative that will lead to better building standards and reduced property insurance losses.

IBHS is interested in all types of materials that are used on the exterior of buildings. While there are impact-resistant standards for roofing materials, there are absolutely no such standards for siding or fenestration, such as doors and windows. Given the many millions of dollars consumers and insurers spend each year on repairing or replacing these materials, one of IBHS' goals is to advance the development of such standards.

IBHS' hail research also will:

- investigate the impact of aging on the performance of building materials when subjected to hail impacts;
- document differences between cosmetic and structural 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; and,
- help people who manage and evaluate different types of risk, including high winds and hail, to understand how various building materials, systems and types are vulnerable to hail damage.

Insurance Institute for Business & Home Safety®

IBHS is a non-profit applied research and communications organization dedicated to reducing property losses due to natural and man-made disasters by building stronger, more resilient communities.

Insurance Institute for Business & Home Safety
4775 East Fowler Ave.
Tampa, FL 33617
(813) 286-3400
DisasterSafety.org