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## How Hail & Tornado Damage Effect Different Types of Roof Surfaces

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### **MODIFIED BITUMEN:**

Modified bitumen roof systems have been popular in this country for more than 30 years. They were originally invented in Europe and provide good service when applied correctly in the appropriate situation. Modified Bitumen is composed of asphalt that has had modifiers processed with it to give it plastic or rubber-like properties. The two most common modifiers are APP (Atactic Polypropylene) and SBS (Styrene Butadiene Styrene). Both types of modified bitumen are provided in rolls approximately three feet wide. The membrane is rolled out and seamed together with heat or cold adhesive. The system is usually made up of two or more plies similar to a built-up roof. Modified bitumen systems are typically more hail resistant than smooth surface built up roofs but other factors come into play. The APP membrane is modified with a plastic and so is less flexible than rubber. This makes it somewhat vulnerable to fracture by hail. The SBS membrane is modified with a type of rubber that is vulnerable to ultraviolet degradation which the sun will deteriorate in short order. Displaced granules in either modified membrane or shingled roofs will result in reduction of service life to the roofing system.

Because of this, the membrane is protected by a granule surface. This granule surfacing may be displaced by hail impact and even though the membrane is not fractured, it would require replacement due to the granule displacement. Both APP and SBS membrane systems can be damaged by hail impact since they are still asphaltic products.

### **BUILT-UP ROOF:**

The beginnings of built-up roofing technology go back as far as ancient Egypt with the use of pitch as a waterproofing agent. The great improvement came with the addition of interleaved felt plies to provide tensile strength to hold the system together. The bitumen used in modern systems may be coal tar pitch or asphalt but both are considered to be built-up roofs. Gravel surfaced built-up roofs are somewhat less likely to be hail damaged than smooth surfaced built-up roofs because the gravel disperses the impact energy but when damage does occur it can be more difficult to pinpoint.

Smooth surfaced or gravel, the result is the same. The asphalt or pitch is displaced or cracked at the surface and the fiberglass felt may be fractured allowing water infiltration

and the beginnings of premature deterioration. Water infiltration into the insulation may spread and what begins as a small puncture may become a large repair. Multiple hail blemishes may require tear-off and re-roof as the only practical remedy.

### **SPRAYED POLYURETHANE FOAM:**

SPUF (Sprayed Polyurethane Foam) roofs are popular in some areas where hailstones are becoming more frequent. Although the foam is closed cell and may not leak immediately after damage by hail, the required repairs to this type of roof can be very costly and the fractures can be particularly difficult to find on some of the newer granule surfaced systems. Hail damage on these roofs can be repaired unless the number of hail fractures is very large which then may require tear-off and re-roof or at least scarifying of the surface and re-coating.

### **METAL ROOFS:**

Hail stones unlike ice balls are naturally formed and have jagged and sharp projections protruding beyond the body of the hail stone. This can cause roof impacts to initially be concentrated on the sharp projections of the hail stone rather than on the smoother rounder surface of an ice ball. The impact energy of the hail stone being concentrated on the few projections of the hail stone causes the projections to dig into, gouge and develop *micro-fracturing* in the Galvalume coating on the steel surfaces. This causes scratches and scrapes on the Galvalume surfaces which either penetrates through the coating or thins the coating at the impact sites.

The indentations from the hail stone impacts cause dimples to be formed in the roof metal at the impact sites. These dimples become small basins that pond the water, retaining it after a rain or snow until it can evaporate. Because of this the salts used on ice and snow as well impurities in the rain and road spatter that may land on the roofs are retained in the dimples. When the water is evaporated from these dimples the impurities remain in the dimples to react with the thinned or removed scrapped and gauged coating on the steel surface. Because they remain in the dimples the next rain or snow concentrates the strength of the impurities still further. The net effect is to increase the concentration of the impurities causing an increasing rate of damage to the roofs at the hail stone impact sites.

Because of this effect the functional damage to the roof is two fold. The first is the water shedding capability allows for water to accumulate in the impact site dimples which concentrates the impurities and deleterious effects on the surface. This reduces the life expectancy of the roof because of the damage caused by the imposition of the concentrated deleterious impurities. The second is the scraping, gouging and formed micro-cracks on the surface thins or removes the coating on the steel roof sheet reducing the life expectancy of the Galvalume decking.

The combined effects of the two situations cause an increasing rate of functional damage to the roofs. Because of the reduction in the long term service life of the roofs and the fact that the damage is distributed throughout the roof areas the entire roof must be replaced.