123 Main Street
Anytown, Anystate 12345

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Anytown, Anystate 12345

Date: December 10, 2025

Overview:

Structural Engineers dot Com has performed an inspection at the above referenced property specifically to determine whether damage to the roof was a result of a hail storm that impacted the property on **May 15, 2024**. The following report is a professional opinion based on accessible portions of the residence. Please note that much of the damage to shingles from hail may be on the back side and not visible without unsealing the shingle.

Property description:

The facility is a two story residential home built in 2007.

Inspection:

Methods:
Structural Engineers dot Com begins our inspections by looking for hail impacts on the roofing material. This is conducted using the Haag 10'x10' test square method, where a 10'x10' square is drawn on one roof slope facing each direction the home has a slope on. Within each square, we look for potential hail and wind damage and mark any damage found with chalk. Structural Engineers dot Com considers hail damage to be indicated by circular areas of granule loss with a random distribution, bruised shingles, or compressed granules. Wind damage is identified by horizontal creases in unsealed shingles. While conducting the inspection, hail damage is circled on the shingles, and wind damage is marked by drawing a horizontal line along the crease. The number of hail and wind damaged shingles in each square is then counted and written at the top of each test square, with H representing hail and W representing wind. After inspecting the shingles, we then inspect any soft metals such as vent pipes, chimney caps, windows, flashing, and gutters for hail damage by lightly rubbing chalk over the metal and shining a flashlight over the area.

Inspection (Continued):

Findings:
Inspection of the roof at the above referenced property revealed that the roof material was a laminated (architectural) fiberglass asphalt shingle with the following impacts.

- Front Slope - H=8+, W=0
- Back Slope - H=8+, W=0
- Left Slope - H=0, W=0
- Right Slope - H=8+, W=0

Additionally, collateral damage was found on a roof vent, metal roofing on the front of the home, and a downspout on the front of the home with dents measured between 3/4” and 1.25” in diameter (Photos 13-16). Multiple areas with stains indicating water intrusion were also noticed on ceilings around the interior of the home.

Weather Analysis:

After completing our on-site inspection, Structural Engineers dot Com reviews weather reports from local news and national weather/storm tracking websites. Our research on the weather impacting the property is shown below.

Radar
Reviewing historical radar data from NOAA at the property confirmed that a strong storm did impact the property on May 15, 2024, approaching from the west/northwest of the property. Although radar cannot be solely relied on to identify storm strength the strong reflectivity gradient with intense precipitation indicated by red directly over the property existing in close proximity to light rainfall indicated by green or no color shows strong updrafts quickly feeding a strong, growing storm cell as the cell passed over the property. The reflectivity map also showed pink, which is ultra high reflectivity precipitation typically indicative of hail, 3.2 miles northwest of the property (Radar Map 1).

Weather Analysis (Continued):

Local News:
The May 15, 2024 storms were well documented by several different news organizations throughout the Charlotte, N.C. area. A report on local news channel WCCB the morning of the storm discussed a potential for quarter or ping pong ball sized hail with 60+ mph wind gusts and WCNC Charlotte Weather sharing a video on YouTube discussing the potential for hail and calling the weather setup similar to an April 2024 storm that brought 2" hail to the region. Video of hail falling in Waxhaw was also found on Facebook from a local meteorologist sharing video from a resident.

Website Data:
Analyzing the historical data for Waxhaw from Weather Underground's station at Charlotte-Monroe Executive Airport for May 15, 2024 supported the claim of a strong thunderstorm impacting the area, as the temperature dropped 16 degrees Fahrenheit between 1:42 PM and 4:35 PM as the storm approached, with the low temperature coinciding with the period of peak precipitation (Weather Data 2). Reviewing the hail and wind damage reports for 5/15/2024 on interactive hail maps showed a report of quarter sized hail near Waxhaw, NC at 5:10 PM, approximately 30 minutes after Weather Underground showed the temperature reaching its lowest point (Weather Data 1). There were also two reports of hail on 5/15/2024 in NOAA's Storm Events Database for Union County, which Waxhaw falls under (Weather Data 3).

Previous Inspection Review:

During our inspection, Structural Engineers dot Com was provided with the report from the previous engineering inspection performed by [Insurance hired engineer] for [Insurance company].

[Insurance hired engineer] stated that the property had zero damage on any slopes consistent with hail or wind damage to shingles and argued that the dents observed in the soft metals indicated a 3/4" hailstone, which was too small to damage the roofing material present on the home. [Insurance hired engineer] believed that the damages observed on the shingles were all a result of mechanical damage from toe boards, birds, fasteners, and foot traffic, not hailstones.

While Structural Engineers dot Com agrees that the roof did have mechanical scuffs and punctures of a size and distribution more consistent with toe boards and brackets than hail strikes and did not include non-circular areas of granule loss in our counts of hail damage, we disagree with the statement that none of the damage present was caused by hail. Our inspection revealed several areas of circular and randomly distributed granule loss (Photos 5-12) sized consistently with the dents we observed in the soft metals around the property (Photos 13-16) that we believe to meet the criteria for hail damage. [Insurance hired engineer] also argued that hailstones large enough to remove large areas of granules would also fracture the mat. Structural Engineers dot Com agrees with this statement, however, it is important to note that damage often begins on the back side of the shingle and can take months to years to become visible on the front after several expansion and contraction cycles and deterioration from the granule loss. During our inspection, we found one hail damaged shingle to be unsealed, allowing us to inspect the back side of the shingle (Photo 5). That inspection confirmed that mat fractures were present on the roof. [Insurance hired engineer] further claimed that the asphalt in the damaged areas being a lighter color than surrounding areas indicated that the damage was caused by a tool, not hail.

Previous Inspection Review (continued):
Structural Engineers dot Com agrees that hail alone will not lighten asphalt, but we disagree with the claim that the discoloration is evidence against hail causing the initial roof damage. One of the main roles granules play is providing UV protection for the asphalt underneath them. When granules are lost from hail or other damage, the asphalt becomes exposed to UV radiation, which causes natural oils from the binders in the asphalt to evaporate. After several months of exposure this is likely what caused the asphalt to lighten in color in the exposed areas compared to covered areas, similar to how a parking lot surface gets lighter over time without seal coating.

Structural Engineers dot Com also disagrees with the claim that the 3/4” dents seen in soft metals would be too small of a hailstone to damage the roofing materials of the type and age present at the property. Review of the Town of Waxhaw and Union County, NC online building permit records did not show any recent work for the property. In many jurisdictions, a full roof replacement would require a building permit to be issued, suggesting that the roof presently installed is original to the home’s 2007 construction. This means the roof had served 17 of the 30 years we believe it to be designed for and had previously been exposed to hail before being damaged by the 5/15/2024 storm. While laminated shingles have traditionally been believed to require 1.25” diameter hailstones to be damaged by hail, new research from the Insurance Institute for Business and Home Safety published this year showed that hail should be looked at cumulatively both within a single storm and over time. The study showed that within a storm, cumulative granule loss from sub-severe (0.7-1.0”) hail can exceed the granules removed by a 2” hailstone, shingles exposed to natural weathering and previous sub-severe hail are up to ten times more likely to be damaged in future storms, and weathered shingles impacted by sub-severe hail saw performance declines of 47 to 67% (Meisenzahl et al.). Given this research and the age of the roof, Structural Engineers dot Com believes the 3/4”-1” dents/areas of granule loss observed are indicative of a hailstone large enough to cause functional damage striking the roof.

Conclusion:

Given the previously discussed information, it is the opinion of Structural Engineers dot Com that the roof did experience functional damage from hail during the May 15, 2024 storm that cannot be restored to a pre-loss condition without replacement. We believe that the majority of the granule loss observed is hail damage, not purely mechanical, and that the age of the roof and previous storm exposure must be considered, making a 3/4”-1” hailstone capable of causing damage.

Regarding the interior water damage, while a damaged vent boot and torn shingles in valleys likely also played a role, Structural Engineers dot Com believes that water intrusion did at least partially result from torn shingles on the back side of the home (Photos 19-20); however, we do not believe that the 5/15/2024 storm that caused the hail damage contained high enough winds to create the level of shingle damage seen. The 5/15/2024 storm showed a peak gust of 23 MPH at the Charlotte-Monroe Executive Airport Weather Underground station (Weather Data 2), which would be unlikely to cause the roof damage seen. Reviewing the NOAA Storm Events Database for wind events in Union County, NC between 1/1/2024 and 5/15/2024 (Weather Data 4), it appears that this roof damage most likely occurred on 5/8/2024, when multiple 50 knot gusts were reported, including one in Waxhaw. Although this storm passed over the entire home, the cells appear to have gotten strongest once they were to the southeast of the home, potentially allowing a damaging gust to impact only the backside of the property.

For any questions regarding this report, please contact Raymond Gessner, P.E. at 757-498-8000.

Sincerely,

Raymond Gessner, P.E.

Supplemental Information:

Impacts of Granule Loss:

Whether to classify the loss of granules as functional or cosmetic damage in hail claims is one of the most heavily debated topics between the roofing and insurance industries. Structural Engineers dot Com believes multiple factors must be analyzed to fully answer the question.

First, we must define what functional damage is. Per Haag Engineering, the organization that conducted much of the testing we base our understanding of hail damage on today, functional damage is defined as damage that results in the "reduction in the water-shedding capability or expected service life of the roofing material". Using that definition, we then look at what purpose granules serve and whether they contribute to the water shedding capability or service life of the roof.

In section seven of their Certified Inspector Program Workbook for the Wind Damage Certification, Haag Engineering describes several key roles that granules play in asphalt shingles, which include: shielding the binder from UV radiation, reflecting heat, adding color, improving fire resistance, and adding weight to increase uplift resistance. While these functions do not play a significant short-term role in water shedding capability, Structural Engineers dot Com believes that several play a major role in determining the service life of the roof.

The two key roles of granules that we focus heavily on are the UV protection and uplift resistance. In traditional asphalt shingles, granules cover a fiberglass mat that is soaked in asphalt. The fiberglass mat core provides the strength for the shingle, while the asphalt seals the fiberglass to provide water resistance. First, we will discuss the UV issue.

Impacts of Granule Loss (Continued):

Whether it's used in roadways or as a shingle binder, asphalt is highly susceptible to damage by UV radiation. UV radiation causes natural oils to evaporate from the bitumen or other binders in the asphalt, making the asphalt brittle and reducing the flexibility of the shingle. This reduced flexibility decreases the shingle's ability to expand and contract, which it must do even more of without granules present to reflect the heat it is exposed to, potentially causing cracks in the asphalt as the shingle moves with weather changes. The brittleness also makes the shingle more likely to crack from any further pressure applied to it if the roof is impacted by future weather events or accessed for inspection/maintenance.

The second issue is uplift resistance. Asphalt shingles, especially architectural varieties, have gotten significantly lighter (losing approximately 100 pounds per square) since testing on hail impact began. With Hagg stating in section 7 of the wind damage certification workbook mentioned previously that granules make up approximately 1/3 of the total weight of each shingle and storms continuing to get stronger, granule weight is even more important to consider for shingle wind resistance today. Without the weight of the granules helping hold them down, shingles have a higher chance of being lifted or even fully torn off in future storms, making them more susceptible to future hail damage, and increasing the likelihood of a water damage claim occurring during future storms.

A second factor to consider in evaluating whether granule loss is functional damage is to reference guidance from the shingle manufacturers. In a technical advisory bulletin to installers and sales teams (TAB-R-108), GAF stated that hail impacts can cause a gradual loss of granules that results in premature aging of the shingles.

Impacts of Granule Loss (Continued):

The bulletin further explained that outward damage, such as granule loss, can be a secondary effect that only becomes visible months to years after initial impact damage to the fiberglass mat or surfacing. This supports the theory that granule loss exposing the asphalt to UV radiation does accelerate aging and also indicates that granule loss may be an indicator of deeper damage to a shingle. While the bulletin states that storm damage can cause shingles to become unsealed, not all impacted shingles come loose, preventing us from fully inspecting the back side of each shingle with granule loss.

Finally, we must look at laboratory research on the topic. A modern study published in September 2025 by the Insurance Institute for Business and Home Safety (IBHS) focused on the impacts of sub-severe hail found that even after just two years of shingle aging, a sub-severe hail impact (<1” hail diameter) leads to a 47% to 67% decrease in shingle performance in future hail events, largely due to accelerated shingle degradation from granule dislodgment, and concluded that “granule loss is a critical damage mode; it exposes the underlying asphalt to UV radiation, increasing brittleness and accelerating degradation” (Meisenzahl et al.).

Given the information presented above, it is the opinion of Structural Engineers dot Com that granule loss resulting from hail impact does directly reduce the service life of a roof through accelerated aging of asphalt due to increased UV exposure on the coating and decreased flexibility of the shingle. Furthermore, the increased potential for cracks to form in the asphalt waterproofing layer of the shingle due to the decreased flexibility of the binding materials and the increased potential for shingle uplift to occur as a result of the decreased shingle weight from lost granules increases the likelihood that the roof will fail to prevent water intrusion in future weather events. While this is an indirect connection, these impacts do also relate granule loss to a decrease in water shedding ability of the roof. Therefore, Structural Engineers dot Com believes that granule loss fits the criteria for decreased roof lifespan and decreased water shedding ability and should be considered functional damage that cannot be restored to a pre-loss condition without roof replacement.

Hail Analysis:

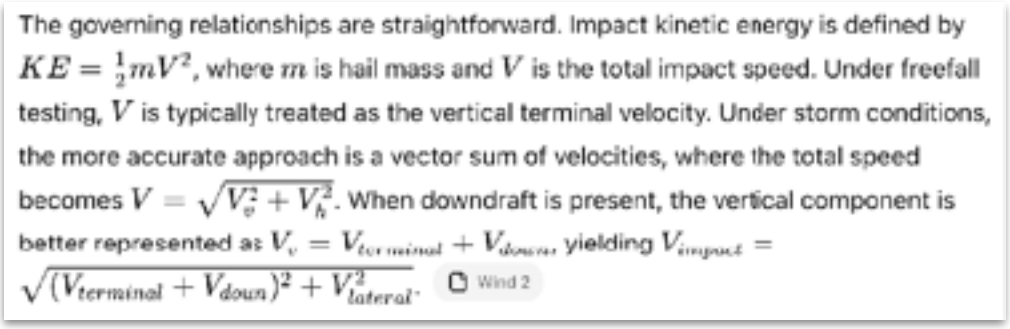
Our hail-causation workflow is built around correlating storm intelligence with ground-truth field evidence so we can reach an objective engineering opinion about whether a specific hail event damaged the facility. We begin by characterizing the hail event at the property location and alleged date of loss using multiple independent inputs, such as official and unofficial weather data, storm reports collected from trained spotters, law enforcement, media and public sources, and other climatological databases. We also review radar and any available hail-mapping products, while recognizing radar limitations and the need to treat size estimates cautiously because radar does not directly measure individual hailstone size at the ground and is best used in context, not as the sole proof of on-site impacts.

We then verify or refute hail damage through a detailed field inspection focused on physically reliable indicators, especially impacts to soft metals and other collateral evidence that consistently records recent hailfall characteristics. During the inspection we document the condition and directionality of impacts, and we use standardized test areas, including representative measurement squares, to quantify the presence and distribution of damage in a way that can be repeated and reviewed. We also evaluate hail “hardness” indicators because softer hail may leave faint spatter and minimal metal denting while harder hail can produce distinct spatter and deeper, more numerous dents.

Finally, we account for site-specific wind effects that may increase hail kinetic energy, including wind-driven impacts and the potential for added lateral and downward components associated with downbursts or microbursts during the storm. With the storm characterization and the documented field evidence considered together, we provide an unbiased conclusion on whether this hail storm more likely than not caused damage at the facility.

Wind Effect on Hail Damage:

Traditional hail-damage thresholds were largely developed from laboratory testing that launches or drops hailstones in near still-air conditions so the impact occurs essentially in vertical freefall at, or near, terminal velocity. That approach creates a repeatable baseline, but it omits key storm physics that routinely exist in severe convection. In real thunderstorms, hail is often embedded in three-dimensional wind fields that include strong lateral winds and downward accelerations associated with precipitation-loaded downdrafts and microbursts. Because kinetic energy depends on the square of velocity, even modest wind-driven increases in impact speed can materially increase the delivered impact energy relative to freefall assumptions.



This directly affects “threshold hail size.” If standards assume a smaller (V) than what occurred, they place the onset of expected damage at hail diameters that are too large. In other words, smaller stones in wind-driven conditions can reach energy levels comparable to larger stones in still air, shifting the effective damage threshold downward. A May 2025 Experimental Study on wind–hail coupling study using wind-tunnel-integrated hail impact testing reported increases in peak impact forces with wind, supporting the conclusion that wind components must be accounted for when correlating hail size to damage potential.

Ref: The Effect of Wind Speed on Hail Impacts by: Yimin Dai, Yao Deng, Hao Luo and Yanwen Long Hunan Provincial Key Laboratory of Structural Wind and Vibration Control, Xiangtan 411201, China School of Civil Engineering, Hunan University of Science and Technology, Xiangtan 411201, China

National Reflectivity Mosaic

National Reflectivity Mosaic uses color to show how strongly radar energy is reflected back by precipitation. As colors warm, the storm is generally producing heavier or larger targets, which can raise the chance of hail, but color alone does not guarantee hail or specify exact size.

Light green usually represents light rain or drizzle and offers little support for hail at the ground. Darker green and yellow suggest steadier to moderate rain and a more organized thunderstorm environment; small hail is possible in these storms, but the reflectivity pattern by itself is not a strong hail signal. Orange and red indicate very heavy precipitation and vigorous convection nearby. When a red area is compact, intense, and moves over a property as a coherent core, engineers become more suspicious that hail may have been present, especially if the core persists rather than flashing briefly.

Purple or magenta corresponds to extremely high reflectivity. A tight purple core embedded within broader red reflectivity is one of the classic radar clues that hail could be occurring aloft and potentially reaching the surface, sometimes with larger stones. Even then, engineers avoid treating purple as “proof,” because torrential rain with very large drops can also produce extreme reflectivity, and mosaics can smooth or slightly shift small features.

For engineering hail investigations, the colors are used to rank likelihood and relative severity at an address: whether the strongest core actually crossed the parcel, how long it lasted, how sharp the gradients were, and whether there is a consistent track. Final judgments are strengthened by dual-polarization hail signatures, hail-size algorithms, warnings or reports, and the roof’s impact morphology and exposure pattern.

Weather Analysis:

When evaluating a property for potential storm damage, we analyze weather data from multiple independent sources to create a detailed, time-stamped picture of hail and wind conditions at the site. We start by gathering radar imagery and storm-cell tracking to identify the specific storm that passed closest to the property. We then verify timing and local conditions using surface observations such as nearby airport stations, mesonets, and other trusted sensors. This combination helps us confirm when the storm arrived, how long it persisted, and whether conditions intensified rapidly during the relevant loss window.

A key part of the analysis is determining storm direction and motion. Storms commonly produce an uneven wind field, and the strongest straight-line winds are often concentrated on the forward-moving side of the storm. In practical terms, we evaluate which “side” of the storm passed the property to determine whether the structure was on the strong wind side that the storm carries with it, or on the weaker wind side that the storm travels against. By plotting the storm track relative to the address, we can estimate the likelihood of peak gust exposure, wind-driven debris, and the potential for wind to amplify roof and exterior impacts.

We also watch for rapid drops in temperature, which can signal powerful downdrafts. As cooled air sinks, it accelerates toward the ground and spreads outward, producing outflow winds that can cause sudden uplift and edge damage on roofing components such as shingles, ridge caps, flashing, vents, and gutters. Finally, we correlate these wind signatures with hail indicators—hail reports, radar-based hail products, and hail size estimates—to understand how hail and wind together can affect a property. Wind can drive hail at an angle, increasing impact energy and spreading damage across more elevations and surfaces.

Industry References:

Our engineering reports are developed to align with established, industry-recognized discussion papers on wind and hail damage evaluation that have been published in multiple engineering journals. These publications provide the technical framework and accepted forensic methodology used throughout the profession, and many are heavily cited by other forensic engineers. By anchoring our analyses to this body of peer-reviewed and widely referenced work, we help ensure our conclusions reflect prevailing engineering principles, consistent terminology, and well-documented investigative approaches.

In addition to relying on this industry literature, our reports are guided by the qualifications and training of our lead engineer, Ray Gessner. Ray has successfully completed all four HAAG Engineering certifications, reinforcing that our evaluations are informed by formalized instruction and tested proficiency in damage recognition, causation analysis, and defensible reporting practices. This combination—published technical guidance and verified credentials—supports clarity, repeatability, and professional rigor from inspection through final opinion.

To further strengthen transparency, we include a references section at the end of our reports listing the primary documents we typically cite. These materials are available for review and provide the underlying basis for the methodologies we use, the standards we apply, and the reasoning behind our conclusions. When read in conjunction with the observations and documentation contained in the report, the referenced papers and technical resources help explain not only what opinions we reached, but also why those opinions are supported by accepted engineering discussions and established forensic practice.

Weather Report: News report morning of storm

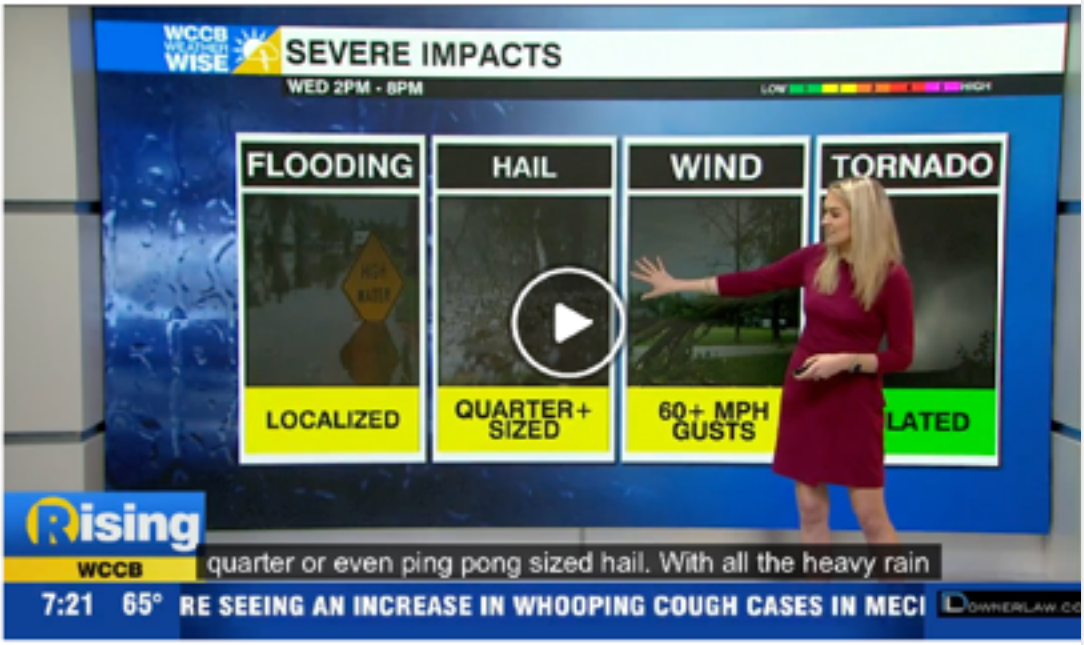
Event Date: 5/15/2024

Report Source: WCCB (Charlotte, NC news station)

Comments: Mention of potential hail and strong wind

WeatherWise Alert: AM Fog and PM Strong to Severe Storm Threat

May 15, 2024 by Nicole Madden



AM Headlines

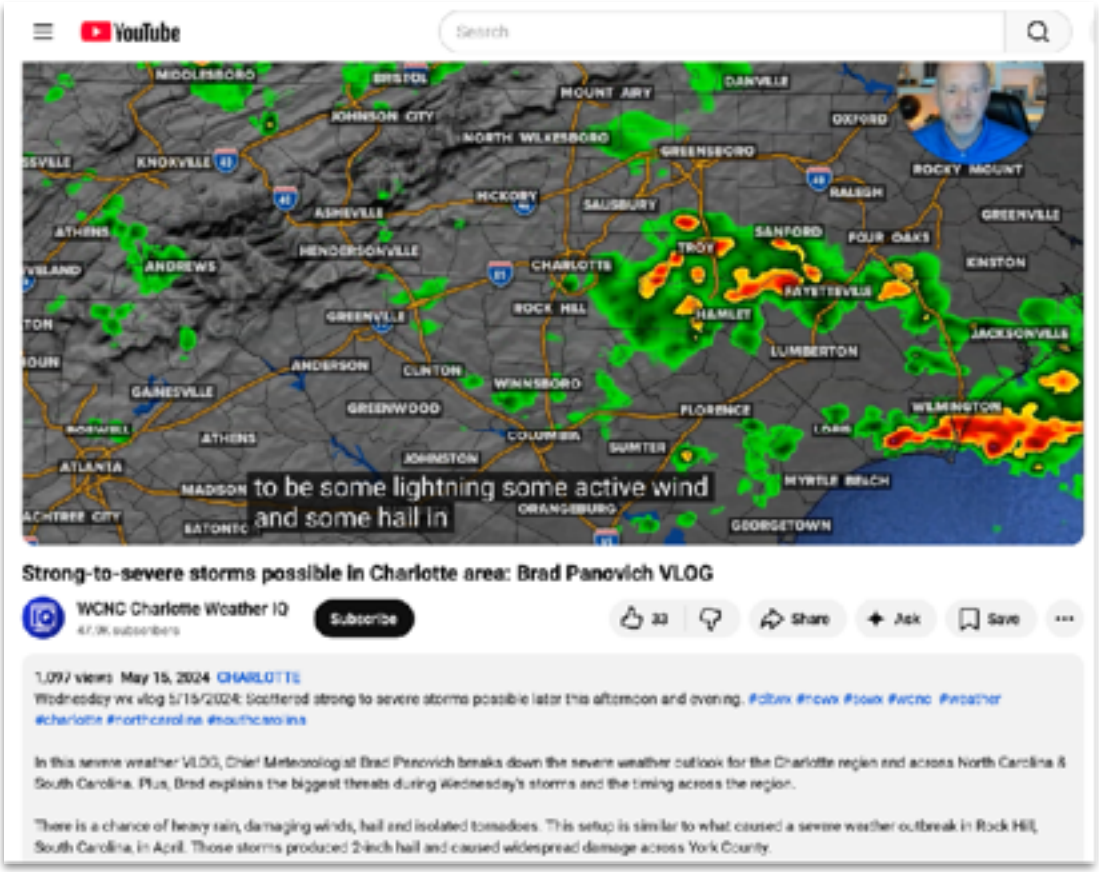
- AM Fog
- PM Storms

Weather Report: YouTube weather broadcast morning of storm

Event Date: 5/15/2024

Report Source: WCNC Charlotte

Comments: Weather report discussing hail potential and comparing system to storm in the previous month that brought 2-inch diameter hail

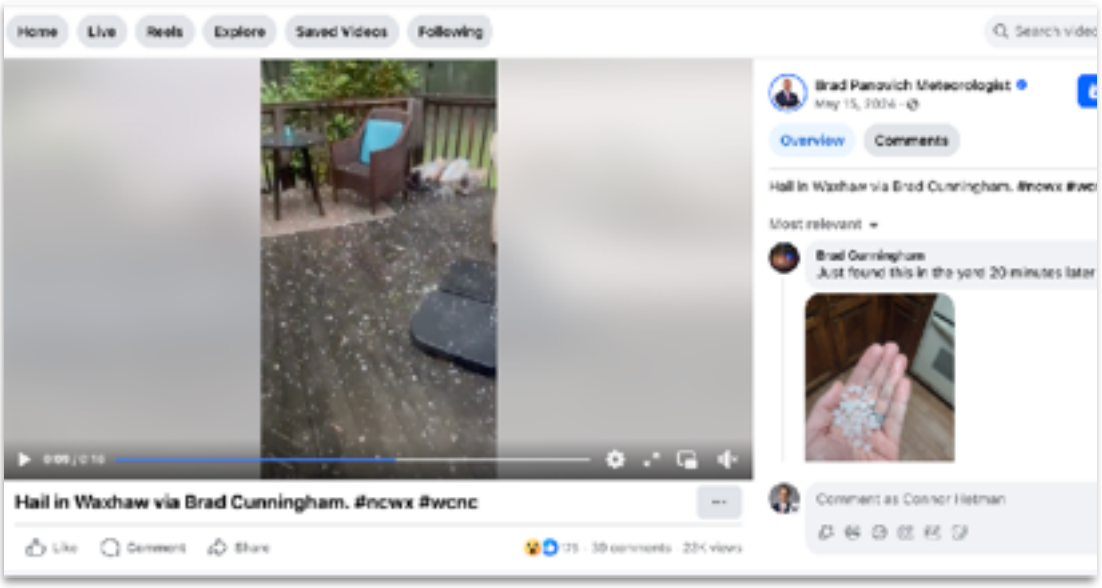


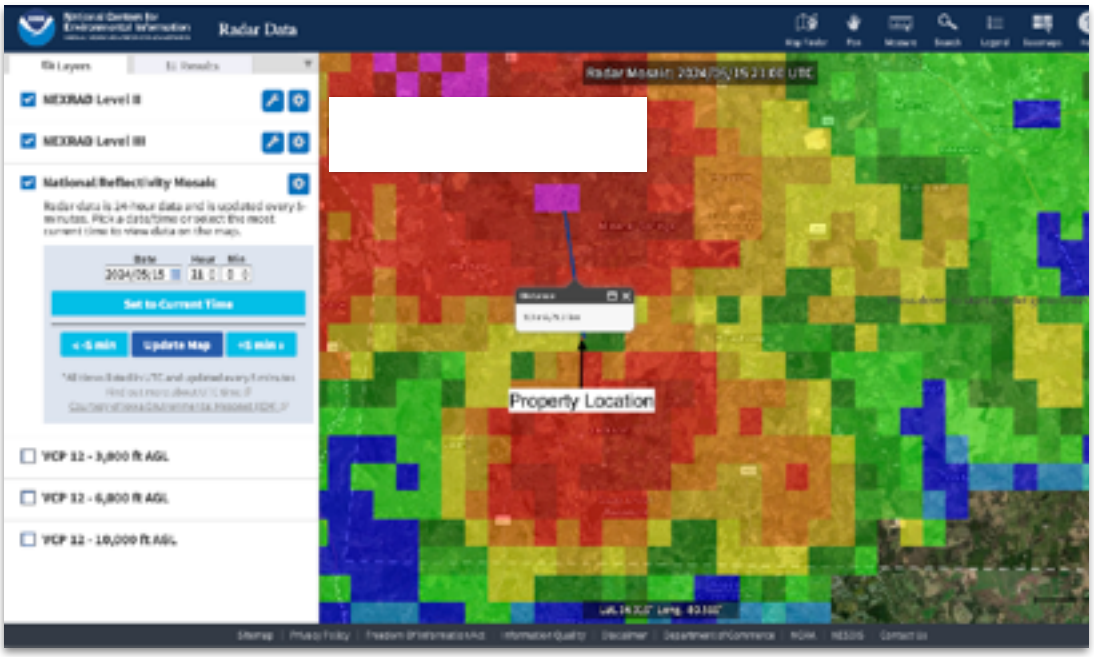
Weather Report: Facebook post from local meteorologist showing hail in Waxhaw, NC

Event Date: 5/15/2024

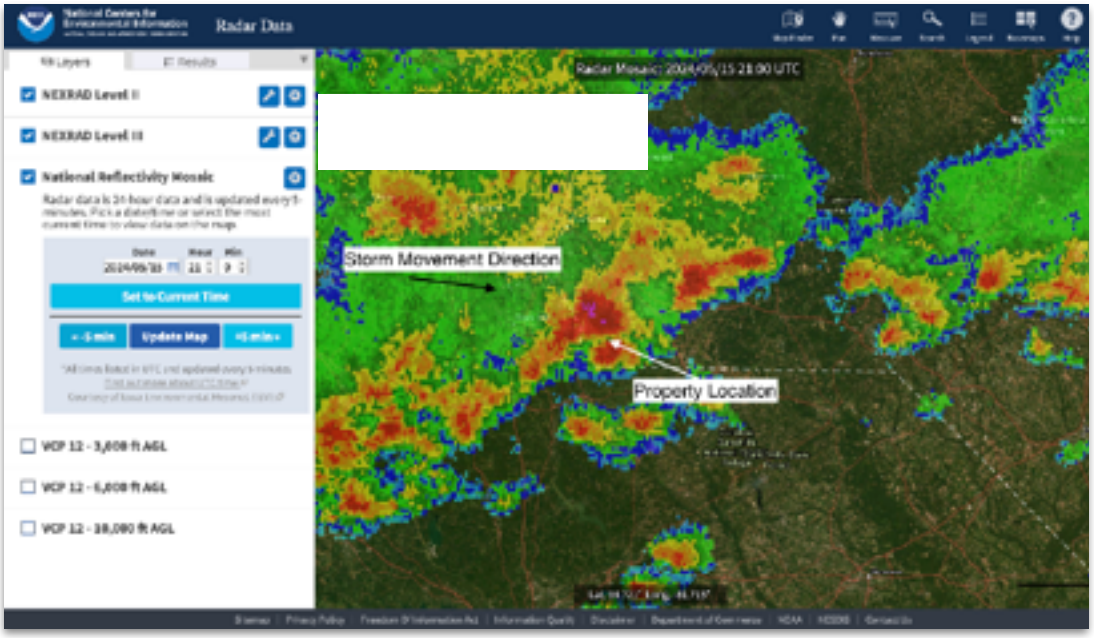
Report Source: Facebook

Comments: Video evidence of hail falling in Waxhaw, NC on 5/15/2024



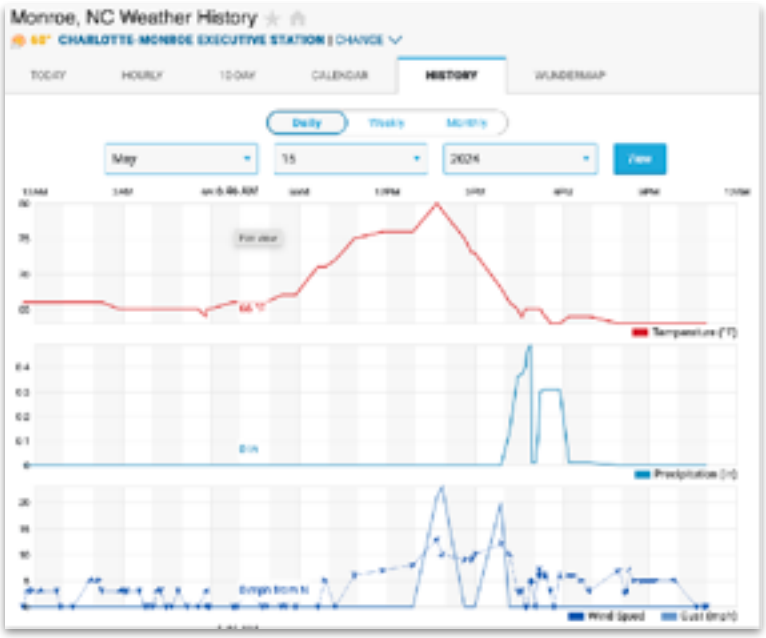


Radar Map 1 - Potential hail on reflectivity radar map near property

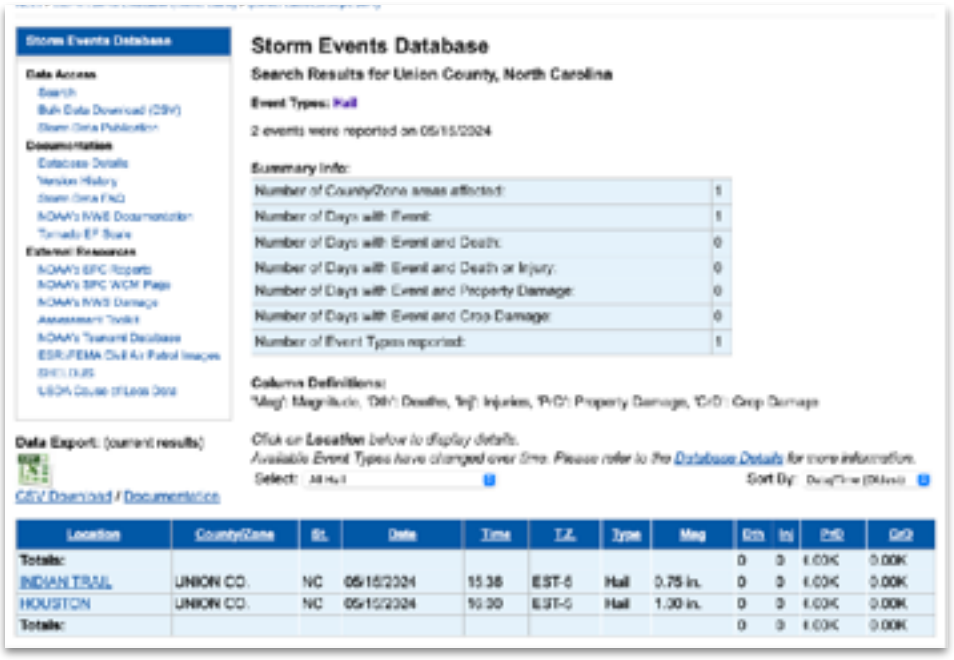


Radar Map 2 - System level view of storm movement and property location

Weather Data 1 - Interactive Hail Maps 5/15/2024 report showing quarter inch hail in Waxhaw, NC



Weather Data 2 - Weather Underground Data



Storm Events Database

Search Results for Union County, North Carolina

Event Types: Hail

2 events were reported on 05/15/2024

Summary Info:

Number of County/Zone areas affected:	1
Number of Days with Event:	1
Number of Days with Event and Death:	0
Number of Days with Event and Death or Injury:	0
Number of Days with Event and Property Damage:	0
Number of Days with Event and Crop Damage:	0
Number of Event Types reported:	1

Column Definitions:

'Mag': Magnitude, 'Dth': Deaths, 'Inj': Injuries, 'PrD': Property Damage, 'CrD': Crop Damage

Click on Location below to display details.

Available Event Types have changed over time. Please refer to the Database Details for more information.

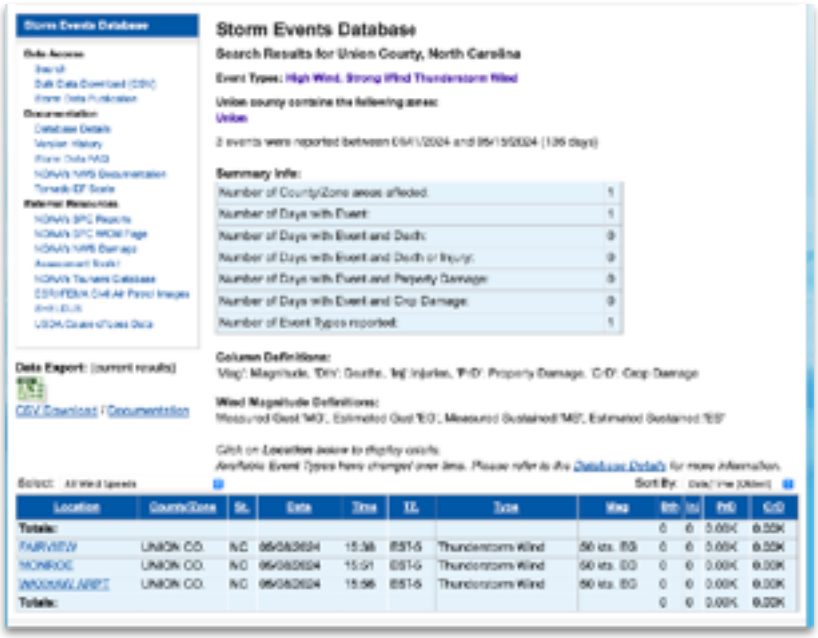
Select: All Hail Sort By: Date/Time (Oldest)

Data Export: (current results)

CSV Download / Documentation

Location	County/Zone	St.	Date	Time	T.Z.	Type	Mag	Dth	Inj	PrD	CrD
Totals:								0	0	0.00K	0.00K
INDIAN TRAIL	UNION CO.	NC	05/15/2024	15:38	EST-5	Hail	0.75 in.	0	0	0.00K	0.00K
HOUSTON	UNION CO.	NC	05/15/2024	16:00	EST-5	Hail	1.00 in.	0	0	0.00K	0.00K
Totals:								0	0	0.00K	0.00K

Weather Data 3 - NOAA Storm Event Database 5/15/2024 Hail Reports



Storm Events Database

Search Results for Union County, North Carolina

Event Types: High Wind, Strong Wind Thunderstorm Wind

Union county contains the following zones:

Union

2 events were reported between 01/01/2024 and 05/15/2024 (135 days)

Summary Info:

Number of County/Zone areas affected:	1
Number of Days with Event:	1
Number of Days with Event and Death:	0
Number of Days with Event and Death or Injury:	0
Number of Days with Event and Property Damage:	0
Number of Days with Event and Crop Damage:	0
Number of Event Types reported:	1

Column Definitions:

'Mag': Magnitude, 'Dth': Deaths, 'Inj': Injuries, 'PrD': Property Damage, 'CrD': Crop Damage

Wind Magnitude Definitions:

Measured Gust 'MG', Estimated Gust 'EG', Measured Sustained 'MS', Estimated Sustained 'ES'

Click on Location below to display details.

Available Event Types have changed over time. Please refer to the Database Details for more information.

Select: All Wind Speeds Sort By: Date/Time (Oldest)

Data Export: (current results)

CSV Download / Documentation

Location	County/Zone	St.	Date	Time	T.Z.	Type	Mag	Dth	Inj	PrD	CrD
Totals:								0	0	0.00K	0.00K
FAIRVIEW	UNION CO.	NC	05/08/2024	15:38	EST-5	Thunderstorm Wind	50 kts. EG	0	0	0.00K	0.00K
MONROE	UNION CO.	NC	05/08/2024	15:51	EST-5	Thunderstorm Wind	50 kts. EG	0	0	0.00K	0.00K
WAXHAW ARPT	UNION CO.	NC	05/08/2024	15:56	EST-5	Thunderstorm Wind	50 kts. EG	0	0	0.00K	0.00K
Totals:								0	0	0.00K	0.00K

Weather Data 4 - NOAA Storm Events Database wind reports search 1/1/2024 to 5/15/2024

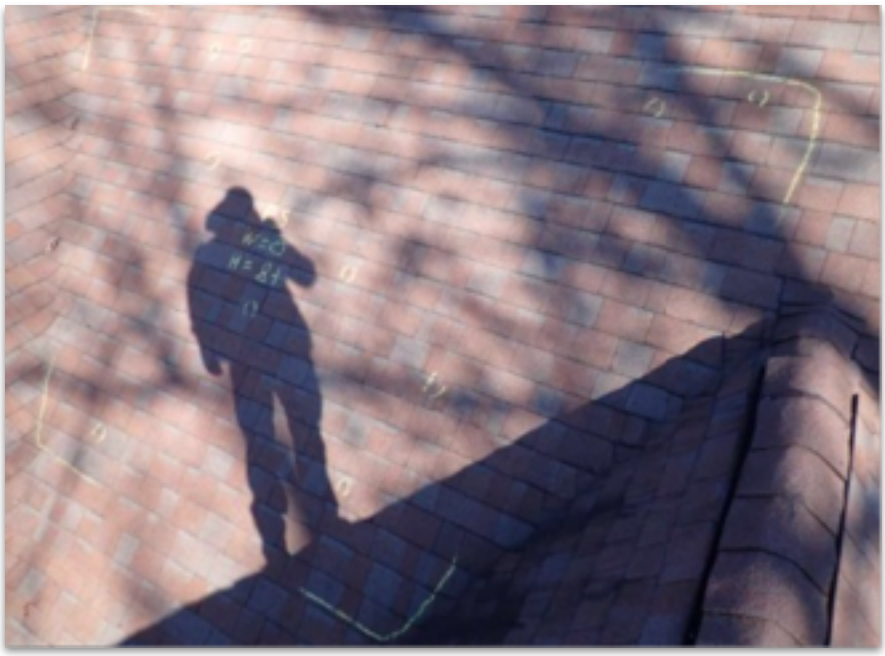


Photo 1: Front slope test square overview

Photo 2: Back slope test square overview

Photo 3: Right slope test square overview

Photo 4: Left slope test square overview

Photo 5: Fracture on back of shingle

Photo 6: Damage close-up photo

Photo 7: Damage close-up photo

Photo 8: Damage close-up photo

Photo 9: Damage close-up photo

Photo 10: Damage close-up photo

Photo 11: Damage close-up photo

Photo 12: Damage close-up photo

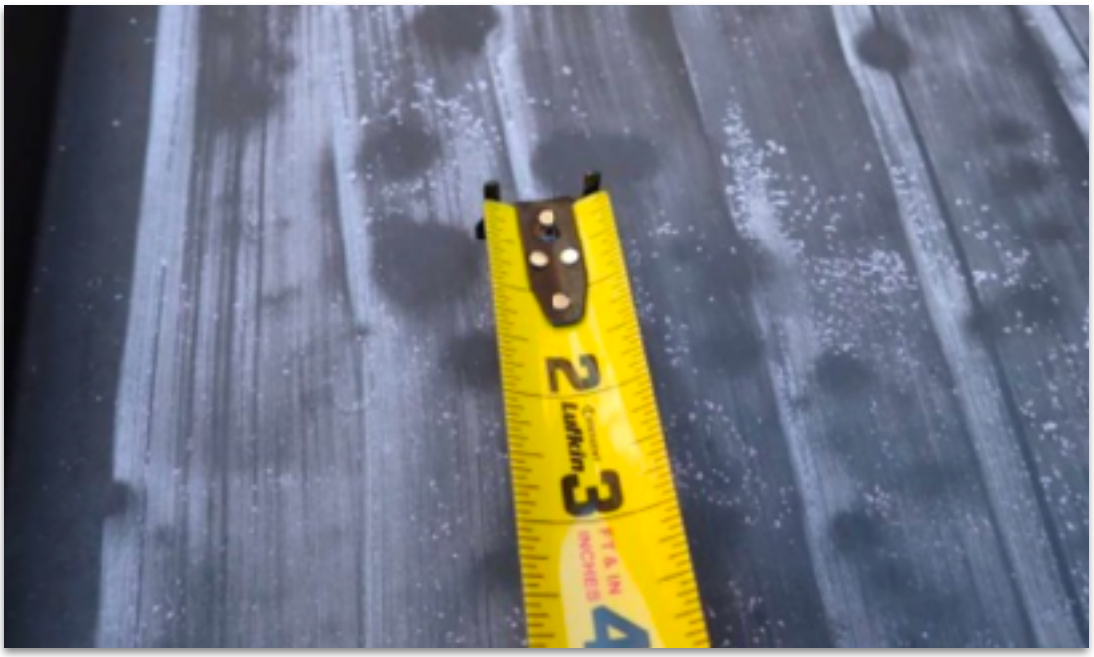


Photo 13: Dents to metal roof

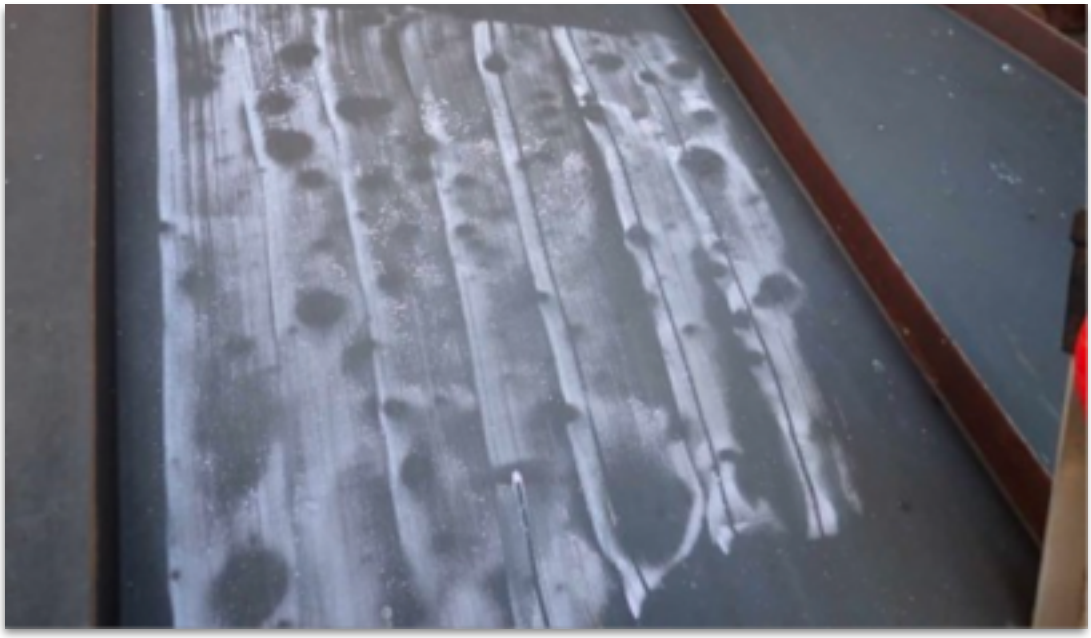


Photo 14: Dents to metal roof

Photo 15: Dent to gutter

Photo 16: Dents in vent on roof

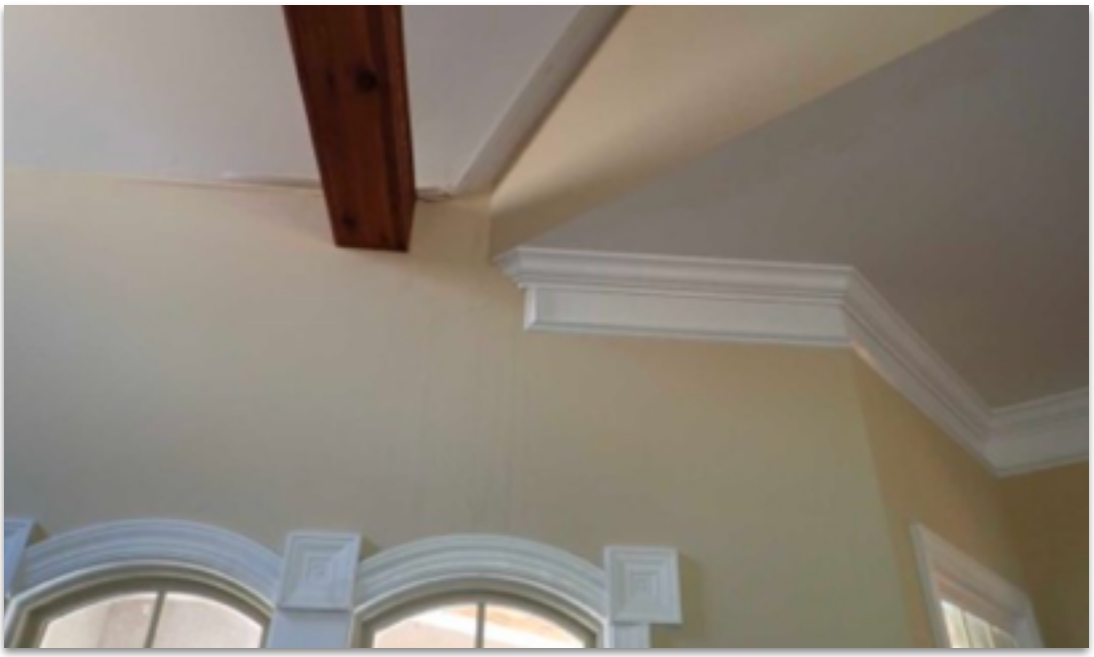


Photo 17: Interior water stains

Photo 18: Interior water stains

Photo 19: Damaged shingles on back of home

Photo 20: Torn shingles on back of home

References and quotes from references:

1) "**Hail Resistance of Roofing Products**" by Sidney H. Greenfield, July 2, 1968. - *Quote : Page 20 "Weathering tends to lower the hail resistance of asphalt shingles.*

2) "**The Effects of Hail on Residential Roofing Products**." By Jim D. Koontz, 1991 International Symposium of Roofing Technology. - Quotes : Page 206 *"Obviously, the terminal velocity of a hailstone is determined by it's free-fall velocity and it's component of it's horizontal wind velocity." Page 208: "as shingles age, asphalt within a shingle obviously hardens and becomes somewhat brittle. This creates a situation when two residences could be next door to one another, and one resident could sustain damage to a slightly older roof, while the other residence could have virtually no damage with a new roofing system. Page 208" Temperature of the roof assembly surface is a definite factor in hail damage. Lower temperature surfaces are much more prone to fracture than higher temperature surfaces. The situation may occur in which rain prior to a hail storm lowers the shingle's surface temperature. This produces a lower threshold for damage. The asphalt in which the granular are imbedded appear to shatter more readily at colder temperatures."*

3) *"**Long Term Effects of Hail Impact Of Hail Impact on Asphalt Shingles - An Interim Report.**" By Scott J Morrison, Haag Engineering Co. Carrollton Texas, 1999 Proceedings of the North American Conference on Roofing Technology. Quote: Page 30-31: Functional damage to any roof covering is defined by Haag Engineering Co. as a diminution of water-shedding capability or reduction in the expected long-term service life of the material. More specifically, applied to asphalt shingles, impact-caused damage is rupture of the reinforcement or displacement of granules sufficient to expose underlying bitumen. The former is a penetration of the roofing shingle that, in effect, removes a layer of the shingles; the latter reduces the expected service life of the material. Page 33: Fractures in new three-tab shingles with fiber glass reinforcement were attributed to tabs not having been sealed prior to impacting. Fractures caused by 1 inch diameter ice balls impacts in three-tab shingles with organic reinforcement - none at year 0 and nine at year 11 - were expected because these shingles became extremely brittle with exposure and, hence, more sensitive to impact caused fractures.*

References and quotes from references:

3) Continued: Page 35: Impact-caused fractures in shingles exposed to natural weathering exhibited progressive more rounded/tapered edges and more oxidized gray color of asphalt as exposure time increased.

4) *"Hail Damage to Asphalt Roof Shingles" by Timothy P. Marshall, Richard F. Herzog, and Scott Morrison. Haag Engineering Co. Dallas, Texas. 2004 American Meteorological Society, Annual Meeting. Quote: page 1 of 6: Granules are applied to single surfaces to give them color, add weight, and to block the underlying asphalt from deleterious effects of the sun. Page 2 of 6: Many asphalt shingle manufactures have issued "technical bulletins" about hail and granular loss, stating that if granules are lost from the shingle due to hail, the shingle has lost life. However there are no published scientific studies to validate this statement.*

5) *Hail Damage Threshold Size for Common Roofing Materials by Timothy Marshall, Richard F. Herzog, Scott J Morrison, and Steven R. Smith. Haag Engineering Co. Dallas Texas. Quote: Page 1: The hail size necessary to inflict property damage was the subject of a recent NWS (National Weather Service) committee meeting on re-evaluating the national severe thunderstorm warning criteria. Page 4: "Therefore, from a roof damage perspective, we believe the hail size threshold for issuing a severe thunderstorm warning can be increased from 3/4 of an inch to one inch in diameter."*

6) *"Experimental Study on The Effects of Wind Speed on Hail Impacts" by Yimin Dad, Yao Deng, Has Luo, and Yanwen Long Hunan Provincial Key Laboratory of Structural Wind and Vibration Control, Xiangtan 411201, China. Hunan university of Science and Technology School of Civil Engineering. Quote: Page 1:* Despite the high frequency of hail events and their associated damage, the synergistic effects of strong winds on hail impact performance remain poorly understood. Quote page 2: In summary, current research on structural wind–hail disasters, both domestically and internationally, predominantly focuses on the isolated impact of hailstones on structures while neglecting the synergistic effects of wind on hail impact dynamics. Page 13: Wind speed exerts significant effects on hail impact dynamics: Higher wind speeds shorten impact duration, accelerate peak force attainment, and amplify peak force magnitudes, thereby enhancing the destructive potential of wind-driven hailstones.

References and quotes from references:

7) Meisenzahl B, Giammanco I and Hedayati F (2025) Sub-severe hail: the missing piece in assessing asphalt shingle risk in North America. Front. Mater. 12:1603074. doi: 10.3389/fmats.2025.1603074. **Quote Page 1:** "exposure to high concentrations of small hailstones can significantly reduce the roof cover's resistance to future large hail events and exacerbate the natural aging of asphalt shingles." **Quote Page 2:** "Granules serve more than an aesthetic purpose on asphalt shingles; their primary role is to protect the underlying asphalt. Once those granules are displaced, the asphalt is exposed to UV radiation and becomes more brittle, exacerbating the natural aging process." **Quote Page 10:** "asphalt shingles can be ten times more susceptible to damage after exposure to natural weathering and sub-severe impacts, when compared to new asphalt shingles". **Quote Page 11:** "When compared to new, non-weathered asphalt shingles, test specimens that experienced both natural weathering and sub-severe impacts within the first few years showed an evident decline in performance, with an average degradation of 47% and reaching as high as 67%."

8. Koontz, Jim D, and Troy L White. *The Effects of Hail on Metal Roofing Systems*, iibec.org/wp-content/uploads/2014-CTS-koontz-white.pdf. Accessed 13 Mar. 2026. **Quote Page 115**: "Substantial indentations at side laps, end laps, or at the juncture with concealed clips can result in conditions that may affect water-shedding capabilities of a metal roof."

9. "August 2018 Blog Post - Haag." *Haag, A Salas O'Brien Company*, 1 Aug. 2024, haagglobal.com/articles/august-2018-blog-post/. **Quote:** "Hail-caused distortions along panel seams can cause openings that allow water intrusion. Hail impacts at fasteners in unsupported seams can sometimes disengage these fasteners. Ruptured panels, disengaged fasteners, and openings along seams have been considered damage to metal roofing because the water-shedding capability had been compromised."

10) Blair, Scott F., et al. "High-resolution hail observations: Implications for NWS warning operations." *Weather and Forecasting*, vol. 32, no. 3, 11 May 2017, pp. 1101–1119, https://doi.org/10.1175/waf-d-16-0203.1. **Quote 1, Page 1102**: "Unfortunately, there remains a high degree of un-certainty that the hail reports obtained during NWS warning verification efforts are representative of the true hailfall of a given storm".

References and quotes from references:

10) Continued: **Quote 2, Page 1102**: “Even with storms over densely populated regions, large hailstones may go unidentified or unreported”. **Quote 3, Page 1104**: “The large majority of hail reports in Storm Data originate from the public or trained storm spotters (Allen and Tippett 2015; Blair and Sanders 2015); thus, reports are traditionally limited to stationary points of an individuals’ residence or business”. **Quote 4, Page 1104**: “Additional uncertainty is introduced by an un-known degree of surface melting on the stone while on the ground before being observed, or whether the individual provided the maximum or average hail size on the ground”. **Quote 5, Page 1105**: “From these storms, a total of 181 Storm Data hail reports were available for comparison with the HailSTONE measurements. Storm Data averaged three hail reports per storm, compared to 66 measurements per storm with the HailSTONE data. Additionally, 32% of the storms sampled by HailSTONE had no Storm Data hail reports available”.

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Raymond P. Gessner, P.E. Professional Engineer

Professional Licenses

- Professional Engineering License #032901 – Commonwealth of Virginia
- Professional Engineering License #36184 – Maryland Department of Labor
- Class A Contractors License # 2705 060992A – Commonwealth of Virginia
- Business Entity License # 0407 004891 – Specialties: Engineering
- Master HVAC License # 2710076347 – Commonwealth of Virginia
- Master Gasfitter License # 2710076347 – Commonwealth of Virginia
- Master Plumber License # 2710076347 – Commonwealth of Virginia
- Fireplace Investigation Research & Education certified inspector
- HAAG Certified Damage Inspector Master Level # 2505109481
- Professional Engineering Licensed in the following states:
- FL, GA, MD, MA, NY, NC, OH, OR, SC, TN, TX, VA, WA, & DC

Education

May 1998 Old Dominion University – Masters of Engineering

June 1991 Virginia Polytechnic Institute & State University – B.S. Civil Engineering

Work History

1999 – Present President: A Step in Time

Performs structural engineering design, analysis and inspections services in addition to managing all firm operations. Prepares engineering reports and engineering studies for an increasing number of clients. Majority of clients (90%) are residential projects. We investigate various property damage from wind, hail, fire and tree impacts.

1997 – 1998 Structural Engineer: Liberty Engineering, P.C. Virginia Beach

Performs structural engineering design, cost estimates and shop drawing review of various projects including residential and commercial locations.

1996 Staff Engineer P.C.L Hardaway Virginia Beach, Va.

Staff engineer involved with fabrication and pile support locations for the Chesapeake Bay Bridge Tunnel Parallel Crossing. Duties include pre-stressed concrete bridge manufacturing with proper induced camber.

1994 - 1996 Structural Engineer – McPherson & Associates, Portsmouth Va.

Performs structural engineering design, cost estimates and shop drawing review of various projects including residential and commercial locations. These projects included the Old Dominion Child Care Facility and University of Virginia Dorm. Other projects included Powhatan Elementary School

Raymond P. Gessner, P.E. Structural Engineer

Work History Continued

1993 - 1994 **Geotechnical Engineer – Geo Design Consultants, Virginia Beach, Va.**

Performs geotechnical engineering field and laboratory projects. These projects included all laboratory management and procedures. These analysis included Proctor, CBR tests, particle size analysis, Atterberg Limits, and concrete compressive testing. Further testing included on site nuclear density testing to determine soil compaction.

1993 - 1993 **Geotechnical Engineer – Froehling & Robertson, Chesapeake Va.**

Performs field engineering testing for various construction projects. These tests include concrete slump test, foundation bearing capacity, nuclear density test, and concrete sample procurement.

Various Projects

3805 Carolyn Ave. Fairfax Va. (tree impact of residence - $300,000 settlement)

3844 Pine Rd. – Portsmouth Va. 3844 (foundation/settlement inspection)

4336 Hickory Rd – Richmond Va. (plumbing failure – 200,000 gallons – foundation)

8237 Nathan Ave. – Norfolk Va. (Foundation settlement – timber girder inspection)

20 Ruffian Dr. – Stafford Va. (structural inspection for termite damage)

9341 Sherwood Dr. - Quinton Va. (structural inspection for unlevel floors)

2907 Eustis Ave. – Chesapeake Va. (structural certification for city of Chesapeake)

21 Beverly Hills Dr. – Newport News Va. (load bearing wall analysis)

4 Estates Dr. – Hampton Va. (foundation inspection)

Expert witness testimony

Virginia Beach District Court – Feb 10, 2016 – Roof truss damage

Virginia Beach District Court – Aug 27, 2014 – Masonry damage