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Stapleton Rowhome Association
Hail Damage Evaluation
10045 Martin Luther King Boulevard
Denver, CO 80238
Farmers File: 5010168593
Haag File: 1121000002-128

Farmers Insurance
PO Box 268994
Oklahoma City, OK 73216-8994

Attention: Mr. Patrick McCourt

February 24, 2021



A handwritten signature in black ink, appearing to read "Matt J. Sitzmann".

Matthew Sitzmann

Feb 24, 2021



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Farmers Insurance
PO Box 268994
Oklahoma City, OK 73216-8994

Attention: Mr. Patrick McCourt

Re: Stapleton Rowhome Association
Hail Damage Evaluation
10045 Martin Luther King Boulevard
Denver, CO 80238
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In accordance with your request, we inspected the Stapleton Rowhome Association buildings to determine the extent of hail-caused damage to the building exteriors and when the damage occurred. We inspected the sites on February 1, 2, and 3, 2021.

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Description

Stapleton Rowhome Association consists of 26 multi-family townhome buildings. Buildings are 1-, 2-, or 3-story tall. Exterior walls are finished with brick masonry, painted fiber cement siding, painted fiberboard panel siding, and fiberboard trim. Windows are vinyl-framed. Many windows feature plastic shutters. Each townhome unit has a two-stall garage. Split-type air conditioning systems provide space heating and cooling. Condenser units for the HVAC systems are mounted on the ground next to the buildings. According to records with the Denver County Tax Assessor, the buildings were constructed between 2004 and 2007.

The dwelling buildings have two design types. One set of dwelling buildings has low-sloped roofs that are covered with adhered 60-mil EPDM (synthetic rubber) membranes. Parapets line three sides of those roofs. EPDM extends up the parapets which in turn are capped with steel coping.

The roofs drain to gutters at the back of the buildings. Balconies and roof-top patios extend outward from the second and third floor levels of the back and front elevations of those buildings. Some of the balconies are atop one-story garage roofs or front entryway roofs. Garage and entryway roofs are covered with EPDM membranes which in turn are covered with composite boards for the roof-top patio. Bay windows extend outward from the front, right, and left elevations of those buildings. Tops of bay windows and ledges at various elevations are capped with painted steel.

The second set of buildings has steep-sloped roofs that are covered with Landmark model, impact resistant laminated asphalt composition shingles manufactured by CertainTeed. Eaves are flashed with ice and water shield. An aerial view of Stapleton Rowhome from Google Earth with buildings labeled is appended to our report as Attachment A. A schedule with the addresses and roofing type for each building is in Attachment B.

Background

We met on site with Ms. Jennifer Kronebusch and her colleagues with Property Solutions Team (PST), a contractor for the homeowner's association. The properties reportedly had been struck by hail, and there was concern about possible damage to the building exteriors from hail.

Weather Information

The National Centers for Environmental Information (NCEI) has 625 reports of observed hail in Denver, Adams, and Arapahoe Counties between January 1, 2004, and October 31, 2020 (the most recent data available). Using the latitude/longitude coordinates provided in the weather record, we determined the distances of the hail reports from a central location between the sites. There were 39 reports of hail within 3-1/2 miles of the central location. Hail 1 inch in diameter was reported 3.5 miles away on July 1, 2019. Hail 1.75 inches in diameter was reported 1.5 miles away on June 19, 2018. Hail 1.5 inches in diameter was reported 2.7 miles away on May 24, 2016, and 1.1 miles away on June 4, 2015. Hail 1.75 inches in diameter was reported 1.2 miles away on April 20, 2005, and 2.8 miles away on June 9, 2004. Hail reports within 3-1/2 miles of the center of the Stapleton Rowhome locations are summarized in Attachment C. Hailstone size varies along a storm track, and a record of hail in one location does not mean that another location necessarily received hail of the same size. Sometimes, hail reports are assigned latitude/longitude coordinates that reference a municipal landmark, such as a city center, and not the actual location at which the observation was made.

A company called Core Logic estimates the potential size of hail that could have fallen at a specific location based on algorithms applied to meteorological data. According to a Hail Verification Report, there were 29 dates in which hail 3/4-inch in diameter or larger may have fallen within 3 miles of a location centered between the Stapleton Rowhome sites dating back to January 1, 2009. There were 7 dates for which Core Logic estimated hail at least 3/4 inch in diameter fell at the central location. The largest hailstones estimated to have fallen at the central location were 1.3 inches in diameter and fell on May 8, 2017, and June 4, 2015. For all other dates, hail falling at



the central location, if any, was estimated to have been smaller than 1 inch in diameter. The full Hail Verification Report is appended as Attachment C. Core Logic reports are based on a study of radar imagery and meteorological conditions and are not themselves confirmed reports of hailfall at a site. They are not a substitute for site-specific observations.

Inspection

The Stapleton Rowhome Association sites had been struck by hail. Metal surfaces had spatter marks where impacting hailstones had removed oxidation and grime. Spatter marks were present on surfaces facing each direction. The largest spatter marks were on top, south, and west facing surfaces and were approximately 3/4 inch wide at their base. Hail dented steel coping, exhaust hoods, and attic vents. Dents in coping and attic vents corresponded with spatter marks confirming the dents were due to recent hail. Hail dented thin-gauge aluminum caps of flue vents.

The EPDM roof membranes had dimples in their surface from the calendaring process in manufacture. The EPDM membranes had been patched in numerous places. There were a few mechanical cuts in EPDM membranes that had not been patched.

We walked large portions of the low-sloped roof sections searching for tears in the EPDM membranes from hail. The EPDM membranes were not torn by hail, including where they were draped over fastener plates or turned up parapets. We pressed with our fingers on the EPDM membrane surfaces and could feel occasional soft spots that likely corresponded with dents in the substrate. To quantify the dents from hail, we marked off 12-inch by 12-inch test areas on the membranes of each roof. Test areas had between 5 and 25 dents within the substrate (14 dents per square foot on average). Dents in the substrate were approximately 1/2 inch wide on average. We selected four of the test areas for closer examination. With three sides of the sample cut, we peeled the membrane back from the substrate. At each sample, there was almost no resistance to uplift between the EPDM membrane and the underlying gypsum cover board. The low-sloped roofs consisted of a plywood or OSB deck, an approximately 3/8-inch-thick layer of gypsum, and the adhered EPDM membrane. The gypsum boards were a powdery consistency indicating they had been exposed to moisture. The facer sheets of the gypsum boards remained adhered to the undersides of the EPDM samples. The gypsum boards had small shallow dents in their top sides from hail. The facer sheet that was stuck to the bottom side of the EPDM had corresponding crow's-foot-type tears at the dents.

Asphalt shingles on steep-sloped roof sections were in near-new condition with regards to weathering. A few shingles had blisters where volatiles had outgassed from the shingle material. The shingle surface was wrinkled in a few places. Some wrinkles corresponded with joints in the decking and were due to relative movement between decking boards. Some wrinkles existed in individual shingles and were due to strains within the shingle layer.

We inspected large portions of the fields of each of the steep-sloped roofs for affects from hail. We also marked off test areas on roof sections facing north, south, east, and west and closely inspected the shingles within the test areas. Test areas each were 100 square feet. Hail bruised



isolated shingles on south, east, and west slopes where they were wrinkled or where they were draped over flashing boots. Shingles that were lying flat on the roof were not bruised by hail. Shingles draped over valleys also were not bruised by hail. A few ridge shingles that were bent to transition from a ridge to a field area of the roof or that were otherwise not supported were bruised. Ridge shingles that were well supported were not bruised. Based on test area data, shingles on south slopes had 1 bruise per 200 square feet on average. Shingles on west slopes had 1 bruise per 400 square feet on average. Shingles on east slopes had 1 bruise per 700 square feet. Shingles on the north the slopes were not bruised by hail. Ridge shingles had approximately 1 bruise per 50 linear feet.

Headwall flashings and boot flashings on flue vents had been re-used from a previous generation of roofing judging by unused nail holes in the flashing. Headwall flashings on south-facing dormers had dents from hail.

Impacting hailstones tore window screens on elevations facing each direction. Screens on south and west elevations had the most tears and the largest tears. Screens on north and east elevations had small tears or, in many instances, no tears. A few of the dwelling buildings had fractures in their vinyl window frames or in the beading of windows from hail. We did not closely inspect every window, but we confirmed fractures in frames of windows on Buildings 19, 20, 21, 22, and 24, and fractures in glazing bead of windows on Buildings 5, 6, 11, 12, 13, and 18. Hail fractured plastic shutters on south and west elevations, and a few shutters on north elevations. Several shutters also were fractured from vibrating in wind, and some shutters were missing altogether. Hail created small shallow dents in the top lips of steel gutters and on downspout extensions. Hail folded over the fins of certain air conditioning condenser units. Fins of other condenser units were protected by louvers and were not dented.

Hail chipped paint finishes on fiberboard windowsills on south and west elevations. Hail also chipped paint on a few north and east elevation windowsills. Paint finishes on vertical surfaces of fiber cement siding boards were not chipped by hail. Hail chipped paint on hand railings around balconies and rooftop patios. Hail scuffed stain finishes on fences around backyards. Several properties had painted iron fences with a durable factory-applied paint finish. Those paint finishes had mechanical scrapes from handling and from thermal affects where two pieces of iron were integrated, but the paint was not fractured by hail.

Hail dented painted steel caps at the tops of some walls extending above rooftop patios and balconies, and painted steel caps on tops of bay windows and ledges beneath windows on bay windows. We were able to see the dents by shading the surfaces with chalk or by sighting across the metal at certain angles to the natural light. Hail dented the steel garage doors on Buildings 7, 8, 9, and 10. Steel garage doors on the other buildings were not dented by hail. Effects of hail on the buildings are summarized in the building schedule in Attachment B. We did not inspect every material at each site, so the list of affected items in the table are not comprehensive.

We took 2,403 digital images of various observations during our inspections. Attached to this report are select images of representative conditions at the sites.



Discussion

Hailstones that are large enough and have sufficient hardness and impact speed can rupture an EPDM membrane. Hail-caused ruptures in EPDM appear as small tears in the material. In addition to size, the angle of impact also plays an important role in the ability of a hailstone to cause damage. Direct impacts, impacts normal to a roof surface, transfer more energy to the roofing than do glancing blows, and thus, windward surfaces usually sustain more damage than leeward surfaces. Where angle of impact is most important on low-slope roofs is at flashings on vertical surfaces. Hailstones on the order of 2 inches in diameter or larger are required to tear EPDM adhered to isoboard insulation. Larger hail is required to tear EPDM atop a rigid substrate like gypsum board. Hailstones on the order of 1-1/4 inches in diameter or larger can bruise conventional laminated asphalt composition shingles. Shingles on the Stapleton Rowhome Association roofs were specially formulated to resist damage from hail and were rated Class 4, according to the UL2218 impact standard. To garner that classification, exemplar shingles had to withstand two impacts from a 2-inch steel ball dropped from 20 feet on its weakest location without rupturing.

The Stapleton Rowhome Association buildings had been struck by hail as indicated by dents in various metal items, fractures in plastic shutters, tears in screens, and chips in paint finishes. Metal surfaces had spatter marks where hail falling recently had removed oxidation. Spatter marks were present on surfaces facing each direction. The largest spatter marks were on south and west surfaces. Spatter marks fade away with time as surfaces re-oxidize and thus provide information about hail falling in the past 2 years or so. The actual length of time a spatter mark is visible depends on the nature of the material with the spatter marks, exposure to sunlight, and other weathering affects. Dents in metal are permanent and provide a record of all the hail to fall at a site.

The EPDM membranes on low-sloped roofs of the Stapleton Rowhome Association were not damaged by hail. The membranes were not torn by hail, including where they were draped over fastener plates or turned up parapets. The membranes were atop a firm substrate and would have required very large hail to deflect the material out of plane enough to tear it. Sizes of dents and spatter marks indicated that hailstones falling at the sites were not nearly large enough to damage an EPDM membrane. Accordingly, the involved EPDM membranes did not have tears from hail.

Hail had created small shallow dents in the gypsum substrate beneath the EPDM membranes. Hail dented approximately 2 to 12 percent (6 percent on average) of the gypsum surface area. The EPDM roof membranes on the Stapleton Rowhome Association roofs are debonded from the gypsum substrates. At samples we evaluated on four separate roofs, the facer sheet on the top side of the gypsum provided little resistance to lifting the EPDM membrane. The gypsum boards were soft and powdery so that the facer sheet remained adhered to the EPDM membrane, and the gypsum board stayed on the deck. The deteriorated condition of the gypsum was caused by persistent wetting from condensation formation on the underside of the membranes over the life of the roofs. If not for the deteriorated condition of the gypsum substrate from condensation, the roofs would have had reliable adhesion despite the hail-caused dents in the gypsum. Addressing

the dents in the gypsum substrate would require replacing the EPDM membrane roofs down to the decks. EPDM membranes beneath rooftop patios would not have been affected by hail.

Hail bruised isolated shingles on the steep-sloped roof sections. The nature of the bruises and their distribution across unsupported shingle areas were indicative of an affect from hail. Bruises from hail were limited to wrinkles in shingles, unsupported areas where shingles were draped over flashing boots, or unsupported ridge shingles. Shingles that were sitting flat on the roof were not bruised by hail. Shingles on the Stapleton Rowhome Association roofs were specially formulated to be resistant to impact from hail, and as a result, shingles with normal support conditions withstood the hail. Shingles on south slopes had 1 bruise per 200 square feet, and shingles on west and east slopes had 1 bruise per 400 square feet and 1 bruise per 700 square feet, respectively. Shingles on north slopes were not bruised. The shingles with bruises can be replaced on an individual basis. Alternatively, the shingles could be left in place to serve out their useful life. The sparse number of shingle bruises from hail, the closed nature of the bruises, and the multi-layer construction of the roofs made it so the roofs will not leak as a result of the hail. Hail had not diminished the performance or longevity of the shingle roofs.

Hail dented various metal appurtenances including steel coping, exhaust vents, flue caps, attic vents, gutters, downspout extensions, and steel flashings and caps on ledges and bay windows. The metal items will continue to perform as intended despite the dents. Addressing the dents would require replacing the metal.

Hail chipped paint finishes on top surfaces of protrusions such as windowsills, trim pieces, and hand railings. Paint chips were most pronounced on south and west surfaces, but there also were isolated chips on horizontal surfaces on north and west elevations. Paint finishes on vertical fiber cement siding were not fractured by hail. Hail scuffed stain finishes on wood fences around backyards. The sills, trim pieces, railings, and fences can be repainted.

Hail fractured vinyl glazing bead on certain windows of a few buildings. Hail also fractured the frames of a few windows. Hail tore screens on windows on every building. Frame and glazing bead fractures were limited to south, west, and east elevation windows. Tears in screens were on windows facing each direction.

The Stapleton Rowhome Association dwellings had been struck by multiple hailstorms over a number years. There were many reports of hail in the weather record close by to the sites confirming that several hailstorms have passed through the area since the buildings were constructed. The EPDM membrane roofs dated back to original construction and would have been exposed to all the hailstorms to have struck the area. Dents in the gypsum substrates, steel coping, and vent caps on those roofs likely were an accumulation from multiple hailstorms. Many dents in the coping featured corresponding spatter marks which confirmed that hail falling recently had contributed dents in the metal and, also, dents in the gypsum substrate. The asphalt shingles were relatively new and only would have been exposed to recent storms. So, the presence of bruises in unsupported shingles and dents in vents on those roofs was further confirmation that hail had fallen at the sites recently. The recent hail had been wind-driven from multiple directions, but



predominantly from the southwest. Effects of hail on the exterior elevations of the buildings corresponded with hail predominantly from the southwest which matched the direction of the recent hailfall. According to the weather record, and an analysis by Core Logic, the most recent dates where hail possibly struck and contributed to the conditions at the sites were August 21, 2019, July 1, 4, and 5, 2019, May 26 and 27, 2019, June 19, 2018, May 28, 2018, and May 8, 2017.

Conclusions

Based on our inspection and analysis of the Stapleton Rowhome Association dwellings, we have reached the following conclusions:

1. The Stapleton Rowhome Association dwellings had been struck by multiple hailstorms over a number of years.
2. The EPDMs membranes on low-sloped roofs were not damaged by hail.
3. Hail dented the gypsum substrates beneath the EPDM membranes. Addressing the dents in the gypsum substrates would require replacing the EPDM membrane roofs down to the decks.
4. Hail bruised isolated shingles on the steep-sloped roof sections. Bruises from hail were limited to wrinkles in shingles, unsupported areas where shingles were draped over flashing boots, or unsupported ridge shingles. The shingles with bruises can be replaced on an individual basis. Alternatively, the shingles could be left in place to serve out their useful life. Hail had not diminished the performance or longevity of the shingle roofs.
5. Hail dented various metal appurtenances including steel coping, exhaust vents, flue caps, attic vents, gutters, downspout extensions, and steel flashings and caps on ledges and bay windows. The metal items will continue to perform as intended despite the dents. Addressing the dents would require replacing the metal.
6. Hail chipped paint on top surfaces of protrusions such as windowsills, trim pieces, and railings. Paint finishes on vertical fiber cement siding were not fractured by hail. Hail scuffed stain finishes on wood fences around backyards. The sills, trim pieces, railings, and fences can be repainted.
7. Hail fractured vinyl glazing bead on certain windows of a few buildings. Hail also fractured the frames of a few windows. Hail tore screens on windows on every building.

8. Dents in the gypsum substrates, steel coping, and vent caps on the low-sloped roofs likely were an accumulation from multiple hailstorms, including a recent storm. The asphalt shingles were relatively new and only would have been exposed to recent storms. Effects of hail on the exterior elevations of the buildings corresponded with the wind-blown direction of recent hail. The most recent dates where hail possibly struck and contributed to the conditions at the sites were August 21, 2019, July 1, 4, and 5, 2019, May 26 and 27, 2019, June 19, 2018, May 28, 2018, and May 8, 2017.

Respectfully submitted,

HAAG ENGINEERING CO.



A handwritten signature in black ink, appearing to read "Matt J. Sitzmann".

Matthew J. Sitzmann, P.E.
Colorado License 43658

Feb 24, 2021

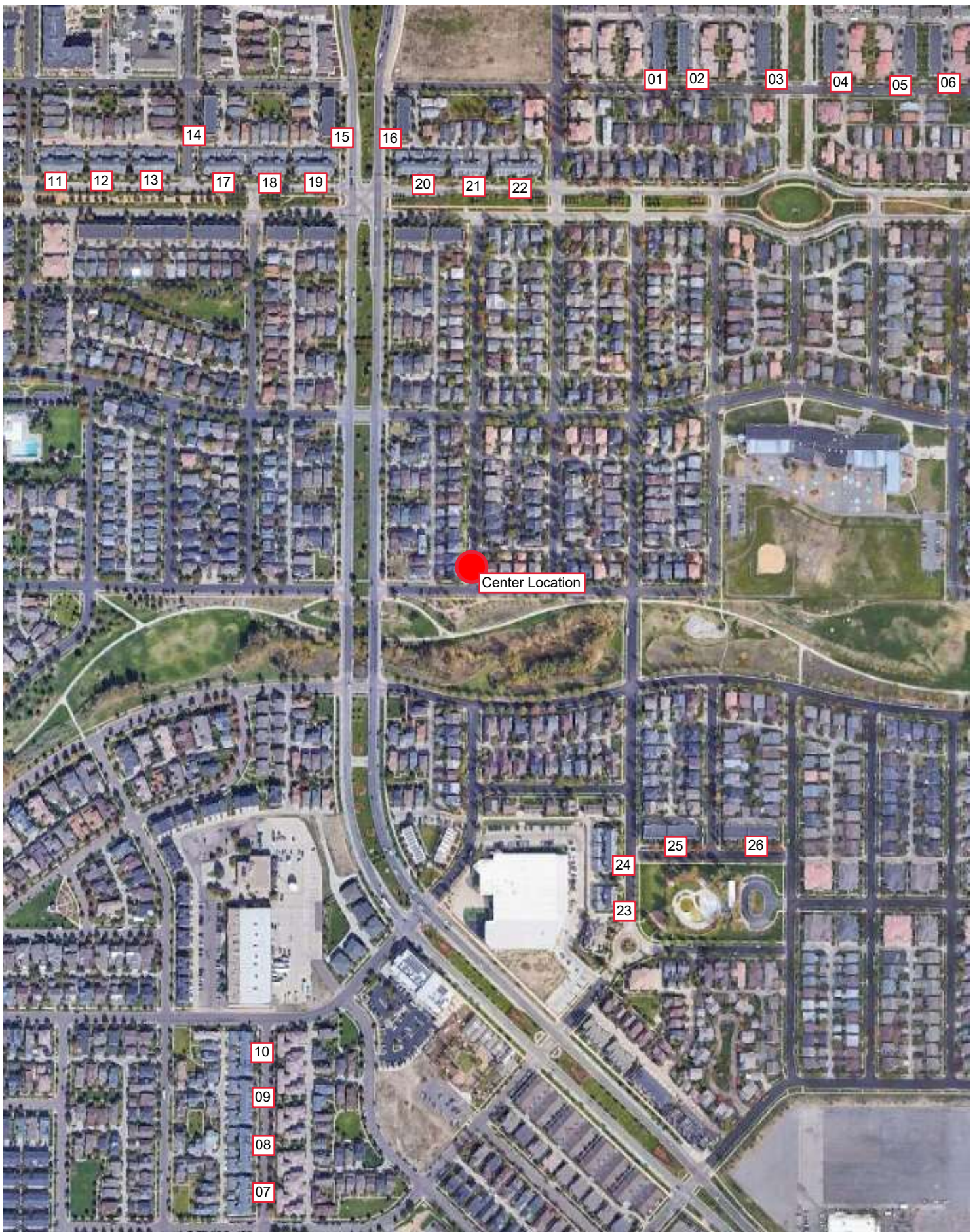
MJS: hnh

Attachments



Attachment A





Aerial view from Google Earth. Stapleton Rowhome Association buildings are labeled for reference.

Attachment B



Attachment B. Building Schedule

Building	Address	Street	Roof	Year Built	Paint Chipped by Hail ²	Effects of Hail on Windows				Coping Dented	Steel Ledges Dented	Vents Dented by Hail			Notes
						Screen Torn	Frame Fractured	Beading Fractured	Shutters Fractured			Exhaust Hoods	Flue Vents	Attic + Exhaust Vents	
1	8703-8719	E 29th Pl	EPDM	2005	S, W, Railings	S, W			X	X	X	X	X		
2	8723-8739	E 29th Pl	EPDM	2005	S, W, Railings	N, S, W			X	X	X	X	X		
3	2953-2967	Xenia St	EPDM	2005	S, W, Railings	N, E			X	X	X	X	X		Mechanical cuts in membrane, leaks into Unit 2955
4	2954-2968	Xenia St	EPDM	2005	S, W, Railings	S, W			X	X	X	X	X		
5	8903-8919	E 29th Pl	EPDM	2006	S, W, Railings	N, S, W		X	X	X	X	X	X		
6	8923-8939	E 29th Pl	EPDM	2005	S, W, Railings	N, S, W		X	X	X	X	X	X		
7	2203-2225	Valentia St	Laminated Shingles	2006	N, S, W, fences	N, S, E, W							X	X	Garage doors dented by hail
8	2231-2245	Valentia St	Laminated Shingles	2006	N, S, W, fences	N, S, E, W							X	X	Garage doors dented by hail
9	2251-2265	Valentia St	Laminated Shingles	2007	N, S, W, fences	S, E, W		X					X	X	Garage doors dented by hail
10	2281-2295	Valentia St	Laminated Shingles	2006	S, W, fences	N, S, E, W							X	X	Garage doors dented by hail
11	8101-8129	E 29th Ave	Laminated Shingles	2006	S, W, fences	S, E, W		X					X		Shutter missing from wind
12	8131-8159	E 29th Ave	Laminated Shingles	2006	S, W, fences	S		X					X		
13	8161-8189	E 29th Ave	Laminated Shingles	2006	S, W, fences	S, W		X					X		
14	2930-2940	Uinta St	EPDM	2005	S, W, Railings	N, S, E, W			X	X	X	X	X		Metal ledges dented, mechanical cut in EPDM
15	2933-2943	Central Park Blvd	EPDM	2005	S, W, Railings	N, S, E, W			X	X	X	X	X		
16	2936-2946	Central Park Blvd	EPDM	2005	S, W, Railings	N, S, W			X	X	X	X	X		Vent terminal dented, metal ledges dented
17	8201-8291	E 29th Ave	Laminated Shingles	2004	S, W, fences	S, W							X	X	
18	8301-8341	E 29th Ave	Laminated Shingles	2004	S, W, fences	S, W		X					X		
19	8351-8393	E 29th Ave	Laminated Shingles	2004	S, W, fences	S, W	X						X	X	
20	8401-8461	E 29th Ave	Laminated Shingles	2004	S, W, fences	S	X		X				X	X	
21	8471-8511	E 29th Ave	Laminated Shingles	2004	S, W, fences	N, S, W	X						X	X	Shutter missing from wind
22	8521-8581	E 29th Ave	Laminated Shingles	2004	S, W, fences	S, W	X						X	X	Shutter missing from wind
23	2445-2449	Xanthia St	Laminated Shingles	2005	S, W, fences	S, E, W							X	X	
24	2493-2509	Xanthia St	Laminated Shingles	2005	S, W, fences	S, W	X						X	X	Shutter missing from wind
25	8705-8745	E 25th Ave	EPDM	2004	S, W, Railings	S, E, W			X	X	X	X	X		
26	8755-8795	E 25th Ave	EPDM	2004	S, W, Railings	S, E, W			X	X	X	X	X		

1. The list of items affected by hail are not comprehensive
2. Paint on sills and tops of some trim chipped. Paint on fiber cement siding was not chipped by hail.

Attachment C



Attachment C. Hail reports from the NCEI made within 3-1/2 miles of Stapleton Rowhomes center

Date	Hail Size (in)	Distance ¹ (miles)	Direction ²
6/9/2004	1	2.8	SW
6/9/2004	1.5	2.8	SW
6/9/2004	1.75	2.8	SW
6/9/2004	1	2.8	SW
6/9/2004	1	2.8	SW
6/9/2004	1	2.8	SW
6/9/2004	0.75	2.8	SW
6/9/2004	1.75	2.8	SW
6/9/2004	0.75	2.8	SW
8/10/2004	0.75	2.8	SW
8/10/2004	0.75	3.2	SW
4/20/2005	1.75	1.2	NE
5/24/2005	0.75	2.8	SW
5/24/2005	1	2.8	SW
6/2/2005	1	2.8	SW
7/15/2005	0.75	3.2	E
4/23/2006	0.88	1.8	S
4/23/2006	1	2.8	SW
6/2/2008	0.88	3.2	SW
6/5/2009	0.88	3.4	W
8/9/2009	1	2.1	E
7/4/2010	1	3.3	N
7/14/2011	1	2.9	SE
5/22/2014	1	3.2	SW
6/24/2014	1	1.8	N
5/28/2015	1	2.7	SE
5/28/2015	1	2.9	SE
6/4/2015	1.5	1.1	E
6/4/2015	0.88	1.6	E
6/24/2015	1	2.5	N
6/24/2015	0.88	2.9	SW
6/24/2015	0.88	2.9	SW
5/24/2016	1.5	2.7	W
5/24/2016	1.5	2.9	SW
6/28/2016	1	1.6	E
7/15/2016	1.25	2.7	W
5/28/2018	0.88	1.1	E
6/19/2018	1.75	1.5	NE
7/1/2019	1	3.5	SE
1. Distance of report from the site.			
2. Direction of the report from the site.			

Attachment D





Weather Verification Services

Hail Verification Report

Claim or Reference #	Stapleton Rowhome Assoc
Insured/Property Owner	Stapleton Rowhome Assoc
Coordinates	Latitude 39.754856, Longitude -104.889308
Date Range	Jan 01, 2009 to Feb 17, 2021
Report Generated	February 18th, 2021 at 23:48:09 UTC

Storm Events

Date	Estimated Maximum Hail Size			
	At Location	Within 1 mi / 1.61 km	Within 3 mi / 4.83 km	Within 10 mi / 16.09 km
Aug 21, 2019	--	--	0.9 in / 2.29 cm	1 in / 2.54 cm
Jul 5, 2019	--	--	1.1 in / 2.79 cm	1.4 in / 3.56 cm
Jul 4, 2019	--	--	0.8 in / 2.03 cm	1.2 in / 3.05 cm
Jul 1, 2019	--	--	0.9 in / 2.29 cm	1 in / 2.54 cm
May 27, 2019	--	--	0.75 in / 1.91 cm	1 in / 2.54 cm
May 26, 2019	--	--	0.9 in / 2.29 cm	1.2 in / 3.05 cm
Jun 19, 2018	--	--	0.75 in / 1.91 cm	2.6 in / 6.6 cm
May 8, 2017	1.3 in / 3.3 cm	1.4 in / 3.56 cm	1.4 in / 3.56 cm	2.5 in / 6.35 cm
May 24, 2016	--	0.8 in / 2.03 cm	1.2 in / 3.05 cm	1.2 in / 3.05 cm
Jun 24, 2015	0.9 in / 2.29 cm	1 in / 2.54 cm	1 in / 2.54 cm	1.4 in / 3.56 cm
Jun 4, 2015	1.3 in / 3.3 cm	1.4 in / 3.56 cm	1.4 in / 3.56 cm	1.8 in / 4.57 cm
May 28, 2015	--	--	1 in / 2.54 cm	1 in / 2.54 cm
Jun 24, 2014	0.75 in / 1.91 cm	0.9 in / 2.29 cm	0.9 in / 2.29 cm	0.9 in / 2.29 cm
Jun 18, 2014	--	0.9 in / 2.29 cm	1 in / 2.54 cm	1 in / 2.54 cm
Jun 14, 2014	--	--	0.9 in / 2.29 cm	1.6 in / 4.06 cm
Jun 5, 2014	--	--	0.9 in / 2.29 cm	1.2 in / 3.05 cm
May 21, 2014	0.9 in / 2.29 cm	1.1 in / 2.79 cm	1.1 in / 2.79 cm	1.1 in / 2.79 cm

Date	Estimated Maximum Hail Size			
	At Location	Within 1 mi / 1.61 km	Within 3 mi / 4.83 km	Within 10 mi / 16.09 km
May 20, 2014	--	--	1 in / 2.54 cm	1.2 in / 3.05 cm
May 5, 2012	--	--	1 in / 2.54 cm	1.2 in / 3.05 cm
Jul 14, 2011	--	--	0.8 in / 2.03 cm	0.9 in / 2.29 cm
Jul 13, 2011	0.9 in / 2.29 cm	1.1 in / 2.79 cm	1.2 in / 3.05 cm	1.5 in / 3.81 cm
Jun 19, 2011	--	--	0.8 in / 2.03 cm	0.9 in / 2.29 cm
May 18, 2011	--	--	0.75 in / 1.91 cm	1.5 in / 3.81 cm
Jul 4, 2010	--	--	0.9 in / 2.29 cm	1 in / 2.54 cm
May 26, 2010	--	--	1.1 in / 2.79 cm	2.2 in / 5.59 cm
Aug 9, 2009	0.8 in / 2.03 cm	0.9 in / 2.29 cm	0.9 in / 2.29 cm	0.9 in / 2.29 cm
Aug 6, 2009	--	--	0.75 in / 1.91 cm	1.2 in / 3.05 cm
Jun 23, 2009	--	--	0.75 in / 1.91 cm	0.75 in / 1.91 cm
Jun 5, 2009	--	--	0.9 in / 2.29 cm	0.9 in / 2.29 cm

- Hail dates begin at 6am CST on the indicated day and end at 6am CST the following day.
- Dash "--" indicates 0.75 in / 1.91 cm or larger hail was detected within 3 mi / 4.83 km, but not at location.
- Hail sizes being reported within this report start at 0.75 in / 1.91 cm and increase in 0.1 in / 0.25 cm increments; rounded to the nearest 0.1 in / 0.25 cm.
- This report contains hail events between Jan 01, 2009 and Feb 17, 2021.

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Photographs





1. Building 01. East elevation.



2. Building 01. North elevation.



3. Building 01. Paint was not chipped by hail.



4. Building 01. Fractures in a plastic shutter.



5. Building 01. West elevation.



6. Building 01. Chip in paint on a railing.



7. Building 01. Dents in condenser fins from hail.



8. Building 01. Chip in paint from hail.



9. Building 01. Chip in paint from hail.



10. Building 01. Dent in a downspout extension from hail.



11. Building 01. Tears in a screen from hail.



12. Building 01. South elevation.



13. Building 01. Chips in paint from hail.



14. Building 01. Ledges of bay windows were capped with painted steel.



15. Building 01. View looking north. The roof was covered with an adhered EPDM membrane.



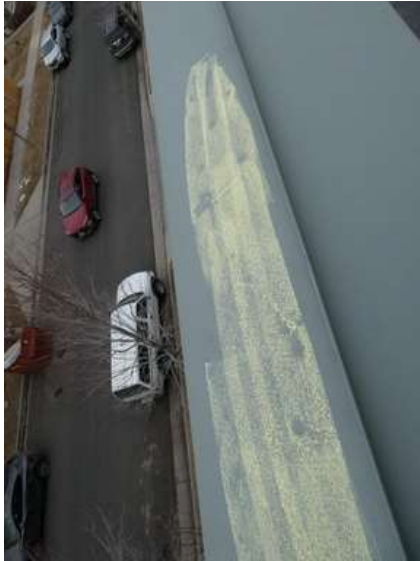
16. Building 01. Product stamp.



17. Building 01. Boot dated, '05'.



18. Building 01. Dents in an exhaust hood from hail.



19. Building 01. Dents in coping from hail.



20. Building 01. Dents in a steel cap from hail.



21. Building 01. Dent in a flue cap from hail.



22. Building 01. Spatter marks on membrane extending up a parapet.



23. Building 01. Test area. Circular chalk marks denote dents in the substrate.



24. Building 01. Sample after cutting. The substrate provided little resistance to uplift.



25. Building 01. Membrane folded back. The gypsum was powdery.



26. Building 01. Powdery gypsum.



27. Building 01. Straight edge over a dent.



28. Building 01. Straight edge over a dent.



29. Building 01. Straight edge over a dent.



30. Building 01. Facer sheet stuck to the underside of the membrane.



31. Building 01. Tear in the facer sheet from hail.



32. Building 01. The roof consisted of a plywood or OSB deck, a layer of gypsum board, and the adhered EPDM membrane.



33. Building 02. West elevation.



34. Building 02. Panel siding and trim.



35. Building 02. Fracture in a shutter.



36. Building 02. Chips in paint from hail.



37. Building 02. Tear in a screen from hail.



38. Building 02. South elevation.



39. Building 02. Tears in a screen from hail.



40. Building 02. East elevation.



41. Building 02. Chips in paint on a south elevation.



42. Building 02. Garage doors were not dented by hail.



43. Building 02. Dent in a downspout extension from hail.



44. Building 02. Dents in condenser fins from hail.



45. Building 02. North elevation.



46. Building 02. Fractures in a shutter.



47. Building 02. Tears in a screen.



48. Building 02. Faint spatter marks on the north side of a transformer cabinet.



49. Building 02. Spatter marks on the west side of the cabinet.



50. Building 02. View looking north. The roof was covered with an adhered EPDM membrane.



51. Building 02. Flashing boot dated, '05'.



52. Building 02. Dents in coping.



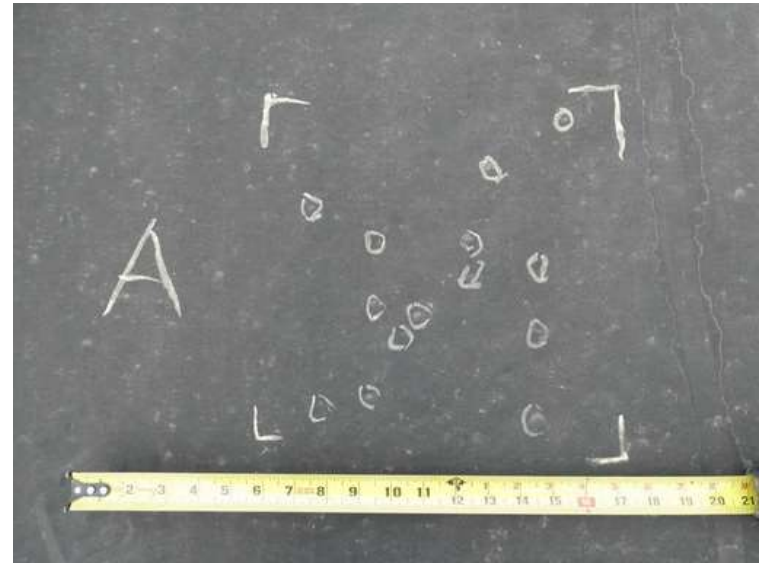
53. Building 02. Dents in a metal cap.



54. Building 02. Dents in an exhaust hood from hail.



55. Building 02. Dent in a flue cap from hail.



56. Building 02. Test area. Circular chalk marks denote dents in the substrate.



57. Building 02. Dent.



58. Building 02. Dent.



59. Building 02. Balconies.



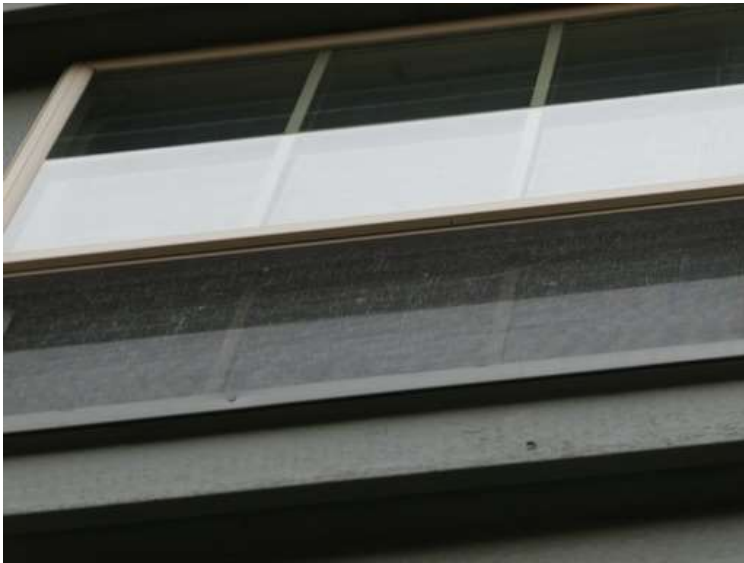
60. Building 02. Scuffs in paint on a railing from hail.



61. Building 03. East elevation.



62. Building 03. North elevation.



63. Building 03. Tears in a screen.



64. Building 03. Fractured shutter.



65. Building 03. West elevation.



66. Building 03. Dents in condenser fins from hail.



67. Building 03. Chips in paint from hail.



68. Building 03. Paint on siding was not chipped by hail.



69. Building 03. Dents in a downspout extension from hail.



70. Building 03. Balconies.



71. Building 03. Chips in worn paint on a hand railing from hail.



72. Building 03. Dents in a painted steel cap from hail.



73. Building 03. View looking north. The roof was covered with an adhered EPDM membrane.



74. Building 03. Boot dated, '05'.



75. Building 03. Mechanical cut in the membrane.



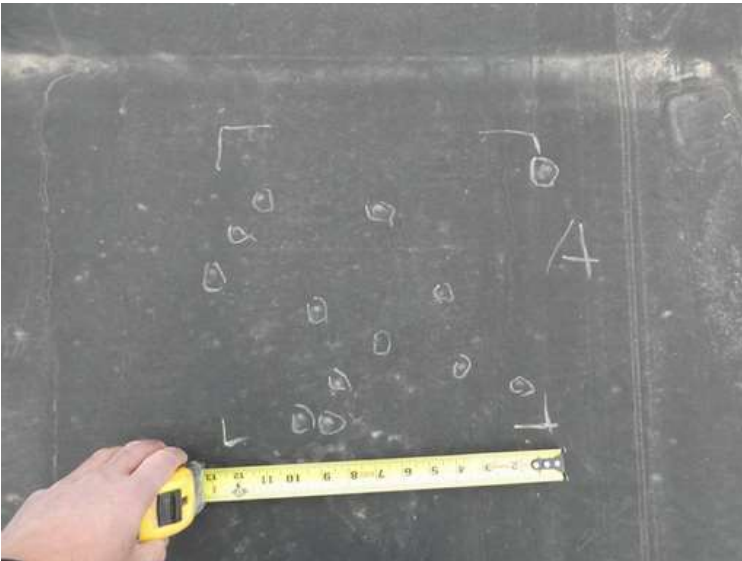
76. Building 03. Dents in coping from hail.



77. Building 03. Dents in an exhaust hood from hail.



78. Building 03. Dents in a flue cap from hail.



79. Building 03. Test area. Circular chalk marks denote dents in the substrate.



80. Building 03. Unit 2955, second floor level.



81. Building 03. Warped flooring in the dining area on the second floor.



82. Building 03. Stained base board.



83. Building 03. Water leaked from above this window on the third floor.



84. Building 03. Water stains.



85. Building 03. Water stains.



86. Building 03. Unit 2955, west elevation.



87. Building 03. Perimeter wall.



88. Building 03. Roof above the water-stained window opening and warped wood flooring. The deck was soft.



89. Building 03. Joint in edge metal. Edge metal was rusted where water pooled at the perimeter of the roof.



90. Building 03. Membrane tied into a parapet above Unit 2955. The deck was soft.



91. Building 03. Opening where water could leak past the roof.



92. Building 04. West elevation.



93. Building 04. Chips in paint from hail.



94. Building 04. Dent in steel flashing a ledge.



95. Building 04. Tears in a screen.



96. Building 04. Warped shutter.



97. Building 04. Spatter marks on an electrical cabinet.



98. Building 04. East elevation.



99. Building 04. Paint finishes on fiber cement siding were not chipped by hail.



100. Building 04. Small dents in condenser fins.



101. Building 04. South elevation.



102. Building 04. Shutter fractured by hail.



103. Building 04. Tear in a screen from hail.



104. Building 04. Chips in paint from hail.



105. Building 04. Balcony.



106. Building 04. View looking north. The roof was covered with an adhered EPDM membrane.



107. Building 04. Boot marked, '05'.



108. Building 04. Dents in coping from hail.



109. Building 04. Dents in an exhaust hood from hail.



110. Building 04. Mechanical cut.



111. Building 04. Mechanical cut.



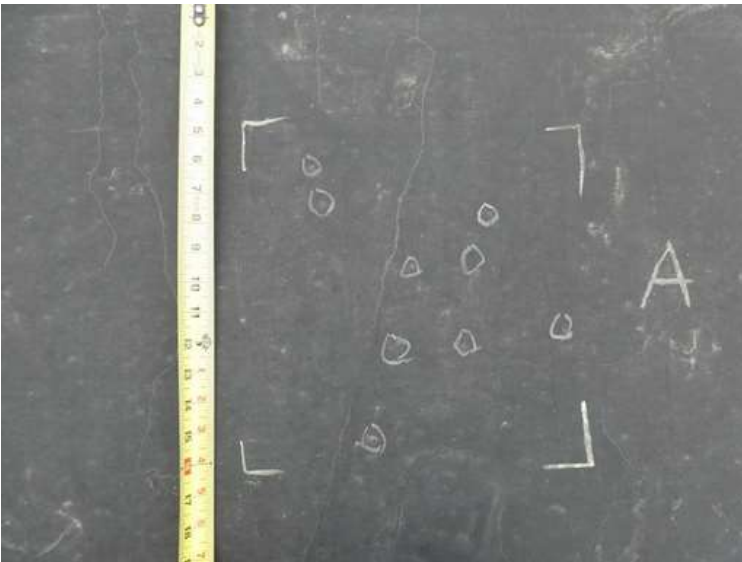
112. Building 04. Mechanical cut.



113. Building 04. Paint chipped by hail.



114. Building 04. Mechanical cut.



115. Building 04. Test area. Circular chalk marks denote dents in the substrate.



116. Building 05. East elevation.



117. Building 05. West elevation.



118. Building 05. Chips in paint from hail.



119. Building 05. Paint on fiber cement siding was not chipped by hail.



120. Building 05. Balconies.



121. Building 05. Dents in a downspout extension from hail.



122. Building 05. South elevation.



123. Building 05. Dent in a screen frame.



124. Building 05. Fracture in vinyl glazing bead.



125. Building 05. View looking north. The roof was covered with an adhered EPDM membrane.



126. Building 05. Boot dated, '06'.



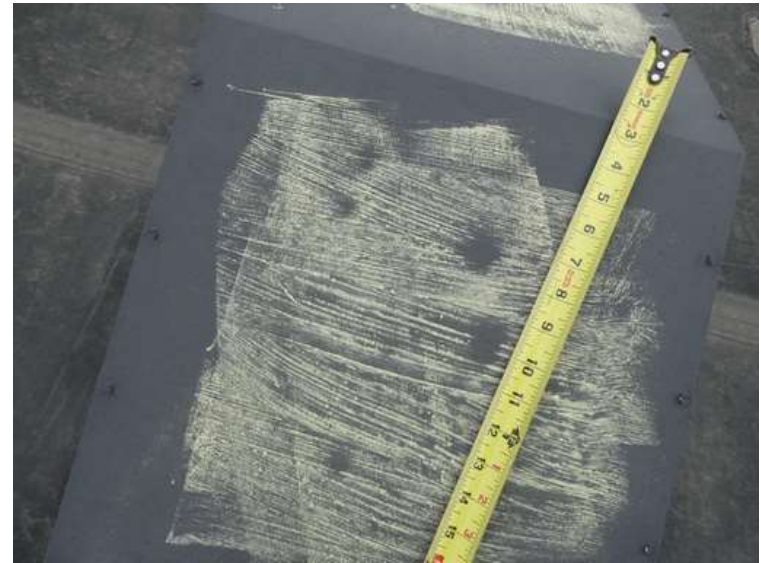
127. Building 05. Patch.



128. Building 05. Spatter marks on membrane turned up a parapet.



129. Building 05. Dent in coping from hail.



130. Building 05. Dents in an exhaust hood from hail.



131. Building 05. Dents in a flue cap from hail.



132. Building 05. Dent in a flue cap from hail.



133. Building 05. Test area. Circular chalk marks denote dents in the substrate.



134. Building 05. Dent.



135. Building 05. Balconies.



136. Building 05. Chips in paint on a railing from hail.



137. Building 05. Painted steel caps.



138. Building 06. West elevation.



139. Building 06. Tears in a screen from hail.



140. Building 06. Chip in paint from hail.



141. Building 06. Beading fractured by hail.



142. Building 06. Beading fractured by hail.



143. Building 06. South elevation.



144. Building 06. Chip in paint from hail.



145. Building 06. Tears in a screen from hail.



146. Building 06. View looking north. The roof was covered with an adhered EPDM membrane.



147. Building 06. Boot dated, '06'.



148. Building 06. Parapets with steel caps.



149. Building 06. Dents in coping from hail.



150. Building 06. Dents in an exhaust hood from hail.



151. Building 06. Dent in a flue cap from hail.



152. Building 06. Test area. Circular chalk marks denote dents in the substrate.



153. Building 06. Sample after cutting.



154. Building 06. The substrate provided little resistance to uplift.



155. Building 06. Gypsum substrate was soft and deteriorated.



156. Building 06. Straight edge over a dent.



157. Building 06. Straight edge over a dent.



158. Building 06. Straight edge over a dent.



159. Building 06. The roof consisted of a plywood or OSB deck, a layer of gypsum board, and the adhered EPDM membrane.



160. Building 06. Tear in the facer sheet adhered to the EPDM membrane from hail.



161. Building 06. Tear in the facer sheet from hail.



162. Building 06. Balcony.



163. Building 06. Chips in paint on a hand railing from hail.



164. Building 07. East elevation.



165. Building 07. Paint finishes on fiber cement siding were not chipped by hail.



166. Building 07. Tear in a screen.



167. Building 07. North elevation.



168. Building 07. Chip in paint finish on a windowsill.



169. Building 07. Chip in stain on a wood fence.



170. Building 07. South elevation.



171. Building 07. Scuffs in stain from hail.



172. Building 07. West elevation.



173. Building 07. Dents in a garage door from hail.



174. Building 07. View looking south. The roof was covered with IR shingles from CertainTeed.



175. Building 07. Dents in a flue cap from hail.



176. Building 07. Wrinkle.



177. Building 07. Re-used base flashing.



178. Building 07. Re-used headwall flashing.



179. Building 07. West test area. No shingles within the test area were bruised by hail.



180. Building 07. East test area. No shingles within the test area were bruised by hail.



181. Building 07. Shingles draped over valleys were not bruised by hail.



182. Building 07. View looking north at garage roofs.



183. Building 07. Shingles were in like-new condition.



184. Building 07. North test area. No shingles within the test area were bruised by hail.



185. Building 07. Wrinkle.



186. Building 07. South test area. No shingles within the test area were bruised by hail.



187. Building 07. West elevation.



188. Building 07. Tears in a screen from hail.



189. Building 07. East elevation of the garages.



190. Building 08. East elevation.



191. Building 08. Tears in a screen.



192. Building 08. West elevation.



193. Building 08. Dent in a garage door from hail.



194. Building 08. Dent.



195. Building 08. Chips in a stained fence from hail.



196. Building 08. Dent in a gutter.



197. Building 08. West elevation.



198. Building 08. Chips in paint.



199. Building 08. Garage roofs.



200. Building 08. South test area. One shingle within the test area was bruised by hail.



201. Building 08. Bruise in a wrinkle.



202. Building 08. Knife cut.



203. Building 08. North test area. No shingles within the test area were bruised by hail.



204. Building 08. View looking north.



205. Building 08. Dents in a flue cap.



206. Building 08. Dent in an exhaust vent.



207. Building 08. North elevation.



208. Building 08. Chip in paint from hail.



209. Building 08. West test area. No shingles within the test area were bruised by hail.



210. Building 08. Bruise in a wrinkle outside the test area.



211. Building 08. East test area. No shingles within the test area were bruised by hail.



212. Building 09. East elevation.



213. Building 09. Chip in paint on a sill.



214. Building 09. Tears in a screen.



215. Building 09. South elevation.



216. Building 09. Chips in paint on a sill.



217. Building 09. West elevation.



218. Building 09. Dent.



219. Building 09. Dent.



220. Building 09. West elevation.



221. Building 09. Tears in a screen.



222. Building 09. Chip in paint on a sill.



223. Building 09. Dents in a downspout.



224. Building 09. Garage roofs.



225. Building 09. Mechanical scuff.



226. Building 09. North test area. No shingles within the test area were bruised by hail.



227. Building 09. South test area. No shingles within the test area were bruised by hail.



228. Building 09. Blister.



229. Building 09. Blisters.



230. Building 09. Chips in paint on a north elevation sill.



231. Building 09. Chips in paint.



232. Building 09. View looking north.



233. Building 09. West test area. No shingles within the test area were bruised by hail.



234. Building 09. Shingles draped over valleys were not bruised by hail.



235. Building 09. East test area. No shingles within the test area were bruised by hail.



236. Building 10. West elevation.



237. Building 10. Paint finishes on fiber cement siding was not chipped by hail.



238. Building 10. North elevation.



239. Building 10. Dent in a screen frame.



240. Building 10. West elevation.



241. Building 10. Dent in a garage door from hail.



242. Building 10. Dents in a garage door.



243. Building 10. Stain scuffed by hail.



244. Building 10. South elevation.



245. Building 10. Tear in a screen from hail.



246. Building 10. View looking north.



247. Building 10. Blister.



248. Building 10. Wrinkle.



249. Building 10. Bruise in a wrinkle.



250. Building 10. Another view.



251. Building 10. West test area. No shingles within the test area were bruised by hail.



252. Building 10. Foot scuff.



253. Building 10. East test area. No shingles within the test area were bruised by hail.



254. Building 10. Dent in an exhaust vent cap from hail.



255. Building 10. Mechanical gouge.



256. Building 10. Garages.



257. Building 10. West elevation.



258. Building 10. Paint chips on a sill.



259. Building 10. South test area. No shingles within the test area were bruised by hail.



260. Building 10. North test area. No shingles within the test area were bruised by hail.



261. Building 11. South elevation.



262. Building 11. Fracture in glazing bead from hail.



263. Building 11. West elevation.



264. Building 11. Fracture in glazing bead from hail.



265. Building 11. North elevation.



266. Building 11. Paint was not chipped from fiber cement siding.



267. Building 11. East elevation.



268. Building 11. View looking west.



269. Building 11. Extra reinforcements under a ridge shingle.



270. Building 11. Dents in a flue cap from hail.



271. Building 11. South test area. No shingles within the test area were bruised by hail.



272. Building 11. Typical shingles.



273. Building 11. North test area. No shingles within the test area were bruised by hail.



274. Building 11. Typical shingle.



275. Building 11. West test area. No shingles within the test area were bruised by hail.



276. Building 11. East test area. No shingles within the test area were bruised by hail.



277. Building 12. South and east elevations.



278. Building 12. Tears in a screen.



279. Building 12. East elevation.



280. Building 12. West elevation.



281. Building 12. Chips in paint on a rotted sill.



282. Building 12. North elevation.



283. Building 12. West test area. No shingles within the test area were bruised by hail.



284. Building 12. Typical shingles.



285. Building 12. Wrinkled roofing from decking movement.



286. Building 12. North test area. No shingles within the test area were bruised by hail.



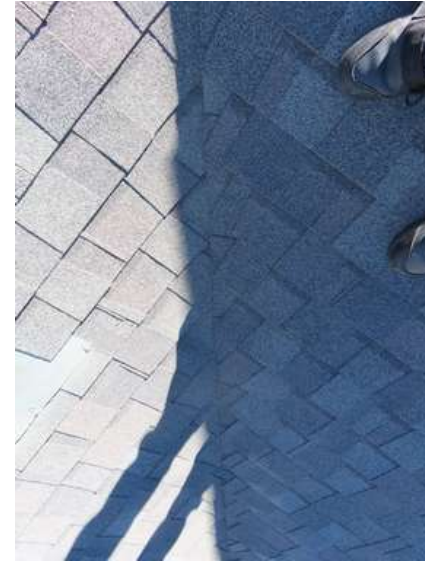
287. Building 12. Typical shingles.



288. Building 12. Shingles draped over the ridge were not bruised by hail.



289. Building 12. Dents from hail.



290. Building 12. Shingles draped over valleys were not bruised by hail.



291. Building 13. South elevation.



292. Building 13. Fractured glazing bead.



293. Building 13. West elevation.



294. Building 13. Paint on a windowsill chipped by hail.



295. Building 13. Scuffs in stain on a wood fence.



296. Building 13. View looking east.



297. Building 13. Dents from hail.



298. Building 13. South test area. No shingles within the test area were bruised by hail.



299. Building 13. Typical shingles.



300. Building 13. North test area. No shingles within the test area were bruised by hail.



301. Building 13. Typical shingles.



302. Building 13. West test area. No shingles within the test area were bruised by hail.



303. Building 13. Shingles draped over a valley were not bruised by hail.



304. Building 14. West elevation.



305. Building 14. Tears in a window screen from hail.



306. Building 14. Chips in paint from hail.



307. Building 14. Fractures in a plastic shutter from hail.



308. Building 14. Dents in metal wall flashing.



309. Building 14. Dent in a downspout extension from hail.



310. Building 14. North elevation.



311. Building 14. Tears in a screen from hail.



312. Building 14. East elevation.



313. Building 14. Tears in a screen from hail.



314. Building 14. South elevation.



315. Building 14. Fractures in a shutter from hail.



316. Building 14. Tears in a screen.



317. Building 14. Chip in paint from hail.



318. Building 14. Painted steel cap.



319. Building 14. View looking south. The roof was covered with an adhered EPDM membrane.



320. Building 14. Flashing boot dated, '04'.



321. Building 14. Mechanical tear in the membrane.



322. Building 14. Spatter marks on coping from recent hail.



323. Building 14. Dent at a spatter mark.



324. Building 14. Dent in a gutter from hail.



325. Building 14. Vent hoods.



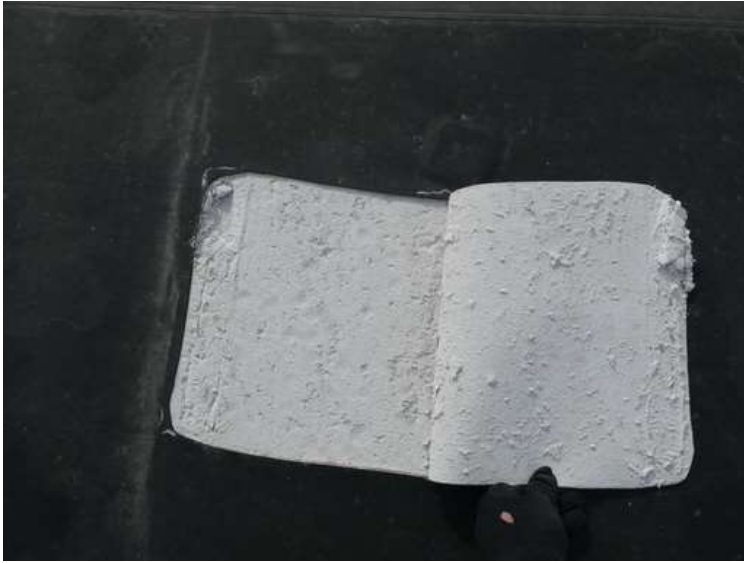
326. Building 14. Dents in a vent hood from hail.



327. Building 14. Dents in a flue cap from hail.



328. Building 14. Membrane area marked for sampling. Circular chalk marks denote dents in the substrate.



329. Building 14. Sample folded back exposing a gypsum board substrate.



330. Building 14. Dents in the gypsum from hail. The gypsum was powdery.



331. Building 14. Tear in the facer sheet adhered to the membrane from hail.



332. Building 14. Tear in the facer sheet adhered to the membrane from hail.



333. Building 14. The roof consisted of an OSB or plywood deck, gypsum board, and the adhered membrane.



334. Building 15. East elevation.



335. Building 15. Dent in a downspout extension from hail.



336. Building 15. Small tear in a screen.



337. Building 15. North elevation.



338. Building 15. Tears in a screen.



339. Building 15. Fractures in a shutter.



340. Building 15. West elevation.



341. Building 15. Chips in paint on a railing.



342. Building 15. Chips in weathered paint from hail.



343. Building 15. Condenser fins dented by hail.



344. Building 15. Dents in a downspout extension from hail.



345. Building 15. Steel cap.



346. Building 15. Dents from hail.



347. Building 15. Fractures in paint finishes on railings from hail.



348. Building 15. South elevation.



349. Building 15. Fractures in a plastic shutter.



350. Building 15. View looking south. The roof was covered with an adhered EPDM membrane.



351. Building 15. Product stamp.



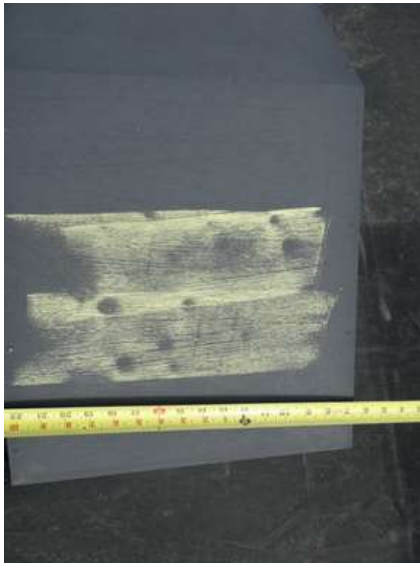
352. Building 15. Flashing boot dated, '05'.



353. Building 15. Flashing boot dated, '04'.



354. Building 15. Patches.



355. Building 15. Dents in an exhaust hood from hail.



356. Building 15. Dents in coping from hail.



357. Building 15. Dent in a flue cap from hail.



358. Building 15. Test area. Circular chalk marks denote dents in the substrate.



359. Building 15. Dent.



360. Building 15. Painted steel caps.



361. Building 16. West elevation.



362. Building 16. Tears in a screen from hail.



363. Building 16. Dents in steel flashing from hail.



364. Building 16. Chip in paint from hail.



365. Building 16. Dent in a vent terminal from hail.



366. Building 16. North elevation.



367. Building 16. Fracture in a shutter.



368. Building 16. Tears in a screen from hail.



369. Building 16. East elevation.



370. Building 16. Dent in a downspout extension from hail.



371. Building 16. Chip in paint on wood trim around a balcony from hail.



372. Building 16. Paint finishes on fiber cement siding was not fractured by hail.



373. Building 16. South elevation.



374. Building 16. Tears in a screen from hail.



375. Building 16. Chip in paint from hail.



376. Building 16. View looking south. The roof was covered with an adhered EPDM membrane.



377. Building 16. Flashing boot dated, '05'.



378. Building 16. Dent in a flue cap from hail.



379. Building 16. Dent in an exhaust hood from hail.



380. Building 16. Dent in coping from hail.



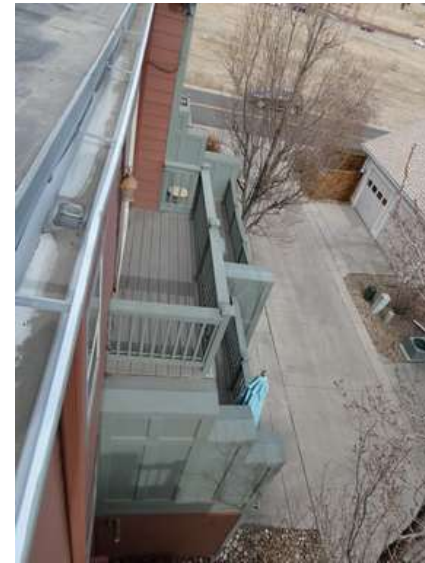
381. Building 16. Test area. Circular chalk marks denote dents in the substrate from hail.



382. Building 16. Dent.



383. Building 16. Dent.



384. Building 16. Balconies.



385. Building 16. Chips in paint finish on a hand railing from hail.



386. Building 17. South and west elevations.



387. Building 17. Paint finishes on fiber cement siding were not chipped by hail.



388. Building 17. West elevation.



389. Building 17. Spatter marks on an electrical box.



390. Building 17. Garage doors were not dented by hail.



391. Building 17. West test area. No shingles within the test area were bruised by hail.



392. Building 17. Typical shingles.



393. Building 17. Dent in an attic vent with a corresponding spatter mark.



394. Building 17. East test area. No shingles within the test area were bruised by hail.



395. Building 17. Dents from hail.



396. Building 17. View looking east.



397. Building 17. Mar from installation.



398. Building 17. Foot scuff.



399. Building 17. South test area. No shingles within the test area were bruised by hail.



400. Building 17. Typical shingles.



401. Building 17. North test area. No shingles within the test area were bruised by hail.



402. Building 18. South and east elevation.



403. Building 18. West elevation.



404. Building 18. Scrape in paint on an iron fence.



405. Building 18. Chip from thermal strains.



406. Building 18. View looking west.



407. Building 18. Bruise at a wrinkle.



408. Building 18. Another view.



409. Building 18. South test area. No shingles within the test area were bruised by hail.



410. Building 18. North test area. No shingles within the test area were bruised by hail.



411. Building 18. Typical shingles.



412. Building 18. Shingles draped over valleys were not bruised by hail.



413. Building 18. Dents in an attic vent from hail.



414. Building 18. Wrinkle.



415. Building 18. East test area. No shingles within the test area were bruised by hail.



416. Building 18. West test area. No shingles within the test area were bruised by hail.



417. Building 19. South elevation.



418. Building 19. Tears in a screen.



419. Building 19. Fractured frame.



420. Building 19. Fractured window frame.



421. Building 19. West elevation.



422. Building 19. Fractures in vinyl above the window.



423. Building 19. Another window.



424. Building 19. Fractures in vinyl above the window.



425. Building 19. East elevation.



426. Building 19. Fractures in a vinyl window frame.



427. Building 19. View looking west.



428. Building 19. Dents from hail.



429. Building 19. Dents from hail.



430. Building 19. Re-used flashing.



431. Building 19. Foot scuff.



432. Building 19. Wrinkle from decking movement.



433. Building 19. South test area. No shingles within the test area were bruised by hail.



434. Building 19. Wrinkle.



435. Building 19. Typical shingles.



436. Building 19. Bruise at a wrinkle.



437. Building 19. Another view.



438. Building 19. Bruise at a wrinkle.



439. Building 19. North test area. No shingles within the test area were bruised by hail.



440. Building 19. Typical shingles.



441. Building 20. South elevation.



442. Building 20. Paint finishes on fiber cement siding were not chipped by hail.



443. Building 20. Chips in paint on a fiberboard sill.



444. Building 20. Tear in a screen.



445. Building 20. Scrape in paint on an iron fence.



446. Building 20. Scrape in paint.



447. Building 20. Fracture in a shutter.



448. Building 20. East elevation.



449. Building 20. Fracture in a vinyl window frame.



450. Building 20. Chip in a wood fence.



451. Building 20. West elevation.



452. Building 20. Fractures in a vinyl window frame.



453. Building 20. Spatter marks on an electrical box.



454. Building 20. North elevation.



455. Building 20. Paint finishes on fiber cement siding were not fractured by hail.



456. Building 20. Garage roofs.



457. Building 20. North elevation.



458. Building 20. Dents in an attic vent from hail.



459. Building 20. Wrinkle.



460. Building 20. West test area. No shingles within the test area were bruised by hail.



461. Building 20. East test area. No shingles within the test area were bruised by hail.



462. Building 20. Shingles draped over valleys were not bruised by hail.



463. Building 20. View looking east.



464. Building 20. Dent in a gutter.



465. Building 20. South test area. No shingles within the test area were bruised by hail.



466. Building 20. Bruise at a wrinkle.



467. Building 20. Re-used headwall flashing.



468. Building 20. North test area. No shingles within the test area were bruised by hail.



469. Building 21. South elevation.



470. Building 21. Tears in a screen from hail.



471. Building 21. Windows missing shutters.



472. Building 21. Chips in paint on a sill from hail.



473. Building 21. Mechanical chip in paint.



474. Building 21. Scuffs in paint.



475. Building 21. West elevation.



476. Building 21. Fractures in a vinyl window frame from hail.



477. Building 21. Fractures in another vinyl window frame.



478. Building 21. Spatter marks on an electrical box from hail.



479. Building 21. Paint finish on fiber cement siding was not fractured by hail.



480. Building 21. Tears in a screen.



481. Building 21. South window.



482. Building 21. Fracture in the frame from hail.



483. Building 21. Dents in condenser fins from hail.



484. Building 21. East elevation.



485. Building 21. Fractures in the vinyl frame from hail.



486. Building 21. North elevation. Garage doors were not dented by hail.



487. Building 21. Ice and water shield.



488. Building 21. North elevation.



489. Building 21. Tear in a window screen.



490. Building 21. Dent in an attic vent from hail.



491. Building 21. West test area. No shingles within the test area were bruised by hail.



492. Building 21. East test area. No shingles within the test area were bruised by hail.



493. Building 21. View looking east.



494. Building 21. Dents from hail.



495. Building 21. Shingles draped over valleys were not bruised by hail.



496. Building 21. Re-used headwall flashing.



497. Building 21. South test area. Two shingles within the test area were bruised at wrinkles by hail.



498. Building 21. Bruise at a wrinkle.



499. Building 21. Bruise at a wrinkle.



500. Building 21. Bruise in a ridge shingle.



501. Building 21. Bruise in a ridge shingle.



502. Building 21. North test area. No shingles within the test area were bruised by hail.



503. Building 22. South elevation.



504. Building 22. Tears in a screen from hail.



505. Building 22. Chip in paint from hail.



506. Building 22. Missing shutter.



507. Building 22. East elevation.



508. Building 22. Spatter marks on an electrical box from hail.



509. Building 22. Fracture in a plastic window frame from hail.



510. Building 22. North elevation. The garage doors were not dented by hail.



511. Building 22. Mechanical dent in a downspout.



512. Building 22. West elevation.



513. Building 22. West elevation.



514. Building 22. Dent in a downspout.



515. Building 22. Fractures in a plastic window frame from hail.



516. Building 22. Fractures in another window frame from hail.



517. Building 22. Dents in condenser fins from hail.



518. Building 22. North elevation.



519. Building 22. Patios.



520. Building 22. East test area. Two shingles within the test area were bruised by hail at wrinkles.



521. Building 22. Bruise in a wrinkle.



522. Building 22. Bruise in a wrinkle.



523. Building 22. West test area. No shingles within the test area were bruised by hail.



524. Building 22. Bruise in a ridge shingle.



525. Building 22. View looking west.



526. Building 22. South test area. No shingles within the test area were bruised by hail.



527. Building 22. Bruise at a wrinkle.



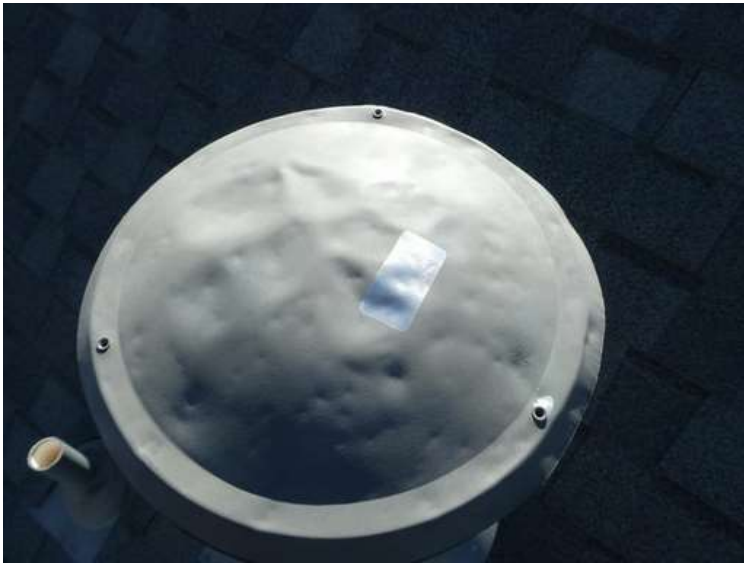
528. Building 22. Bruise in a ridge shingle.



529. Building 22. North test area. No shingles within the test area were bruised by hail.



530. Building 22. Shingles draped over valleys were not bruised by hail.



531. Building 22. Dents from hail.



532. Building 22. Dent in an attic vent from hail.



533. Building 22. Re-used flashing.



534. Building 22. Dent in headwall flashing.



535. Building 22. Bruise in a ridge shingle.



536. Building 22. Cellophane strip indicating impact resistant shingle.



537. Building 23. East elevation.



538. Building 23. Tears in a screen.



539. Building 23. Mechanical chip in paint on an iron fence.



540. Building 23. North elevation.



541. Building 23. Small dents in condenser fins from hail.



542. Building 23. North and west elevations.



543. Building 23. Garage doors were not dented by hail.



544. Building 23. Dent in a downspout extension from hail.



545. Building 23. South elevation.



546. Building 23. Paint finishes on fiber cement siding were not chipped by hail.



547. Building 23. Dent in a wood fence.



548. Building 23. Chip in paint from hail.



549. Building 23. West elevation.



550. Building 23. Chips in paint on a fiberboard windowsill.



551. Building 23. Tears in a screen.



552. Building 23. Chips in paint from hail.



553. Building 23. Vents.



554. Building 23. Dent in a steel attic vent from hail.



555. Building 23. Bruise in a ridge shingle from hail.



556. Building 23. Bruise in a shingle draped over flashing from hail.



557. Building 23. Foot scuff.



558. Building 23. Wrinkle.



559. Building 23. Bruise at a wrinkle.



560. Building 23. View looking north.



561. Building 23. View looking northwest.



562. Building 23. Shingles draped over valleys were not bruised by hail.



563. Building 23. Dents in a flue cap from hail.



564. Building 23. West test area. No shingles within the test area were bruised by hail.



565. Building 23. Bruise in a wrinkle.



566. Building 23. East test area. No shingles within the test area were bruised by hail.



567. Building 23. South test area. No shingles within the test area were bruised by hail.



568. Building 23. North test area. No shingles within the test area were bruised by hail.



569. Building 23. Mechanical gouge.



570. Building 24. East elevation.



571. Building 24. Fractures in a shutter from wind.



572. Building 24. Tear in a screen.



573. Building 24. Mechanical scuffs.



574. Building 24. South elevation.



575. Building 24. Fracture in a vinyl window frame from hail.



576. Building 24. North elevation.



577. Building 24. Small dents in condenser fins from hail.



578. Building 24. North and west elevations.



579. Building 24. Garage doors were not dented by hail.



580. Building 24. Paint finishes on siding were not chipped by hail.



581. Building 24. South elevation.



582. Building 24. Chip in paint from hail.



583. Building 24. Tears in a screen from hail.



584. Building 24. West elevation.



585. Building 24. Tears from hail.



586. Building 24. Chips in paint from hail.



587. Building 24. Dent in headwall flashing.



588. Building 24. Garage roofs.



589. Building 24. Scuff.



590. Building 24. Dents from hail.



591. Building 24. Bruise in a wrinkle.



592. Building 24. Closer view.



593. Building 24. Knife cuts.



594. Building 24. North test area. No shingles within the test area were bruised by hail.



595. Building 24. South test area. No shingles within the test area were bruised by hail.



596. Building 24. East test area. No shingles within the test area were bruised by hail.



597. Building 24. Shingles draped over valleys were not bruised by hail.



598. Building 24. Foot scuff.



599. Building 24. West test area. No shingles within the test area were bruised by hail.



600. Building 24. Dent from hail.



601. Building 24. Cellophane strip indicating Class 4 impact resistant shingle.



602. Building 25. South elevation.



603. Building 25. Tears in a screen.



604. Building 25. Fractured shutter.



605. Building 25. East elevation.



606. Building 25. Spatter marks on the top of a transformer cabinet.



607. Building 25. North elevation.



608. Building 25. Paint finishes on fiber cement siding were not chipped by hail.



609. Building 25. Dent in a downspout extension from hail.



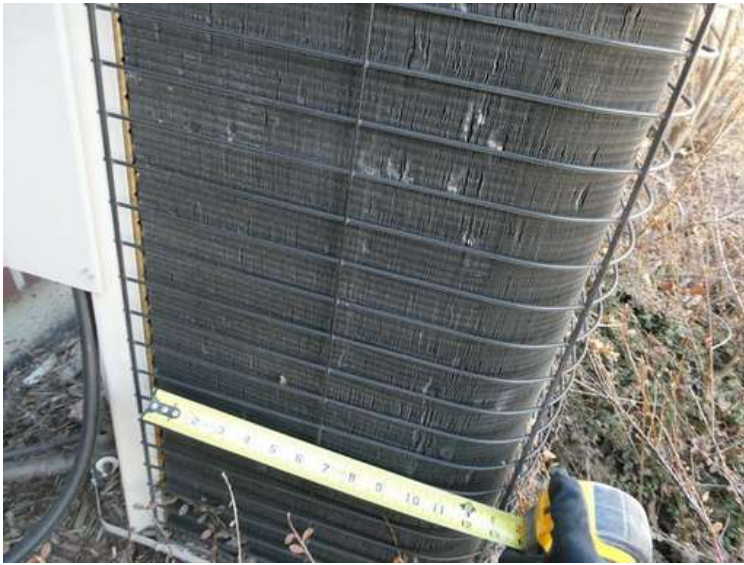
610. Building 25. West elevation.



611. Building 25. Fractured shutter.



612. Building 25. Chip in paint on a west elevation.



613. Building 25. Dents in condenser fins from hail.



614. Building 25. Dents in a steel cap from hail.



615. Building 25. View looking west. The roof was covered with an adhered EPDM membrane.



616. Building 25. View looking west.



617. Building 25. Product stamp.



618. Building 25. Boot dated, '03'.



619. Building 25. Dent in coping from hail.



620. Building 25. Dents in an exhaust hood from hail.



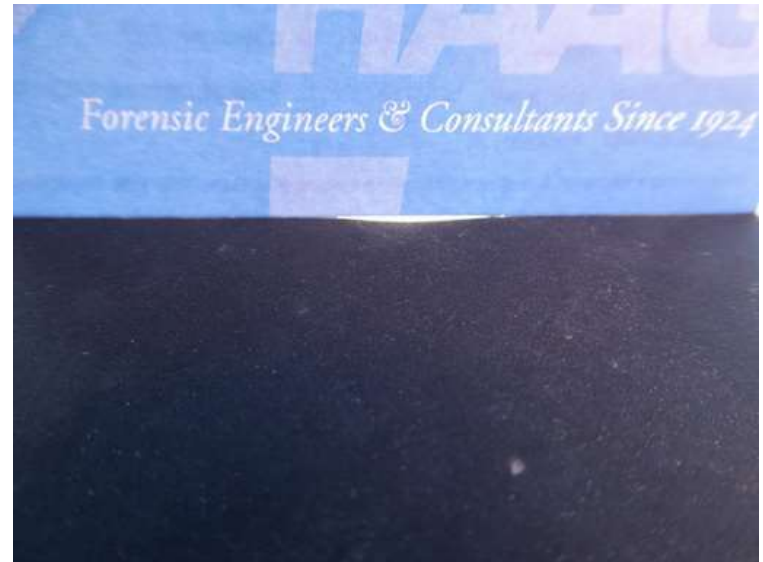
621. Building 25. Dent in the roof surface.



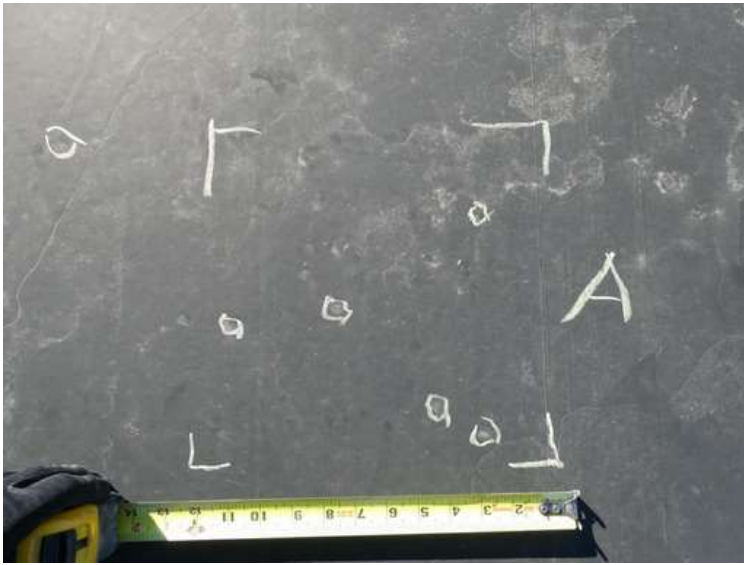
622. Building 25. Straight edge over a dent.



623. Building 25. Straight edge over a dent.



624. Building 25. Straight edge over a dent.



625. Building 25. Test area. Circular chalk marks denote dents from hail.



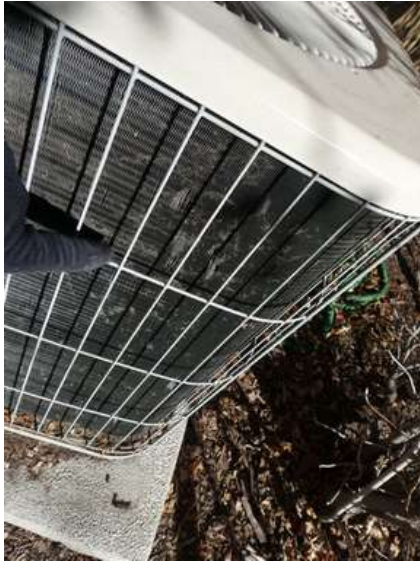
626. Building 26. South elevation.



627. Building 26. Dent in steel flashing.



628. Building 26. Tears in a screen.



629. Building 26. Dents in condenser fins.



630. Building 26. Fractured shutter.



631. Building 26. East elevation.



632. Building 26. Tears in a screen.



633. Building 26. North elevation.



634. Building 26. West elevation.



635. Building 26. Tears in a screen.



636. Building 26. Dent in a steel ledge.



637. Building 26. Chips in paint from hail.



638. Building 26. Spatter marks on an electrical box.



639. Building 26. Dents in a steel cap from hail.



640. Building 26. Dent in a gutter.



641. Building 26. View looking east. The roof was covered with an adhered EPDM membrane.



642. Building 26. View looking east.



643. Building 26. Boot dated, '04'.



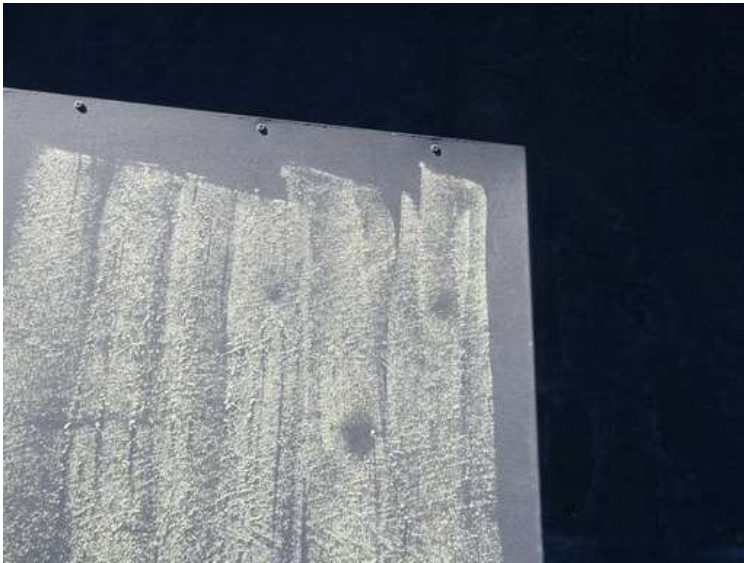
644. Building 26. Patches.



645. Building 26. Dent in coping from hail.



646. Building 26. Painted steel caps on ledges.



647. Building 26. Dents in an exhaust hood from hail.



648. Building 26. Dents in the roof surface.



649. Building 26. Straight edge over a dent.



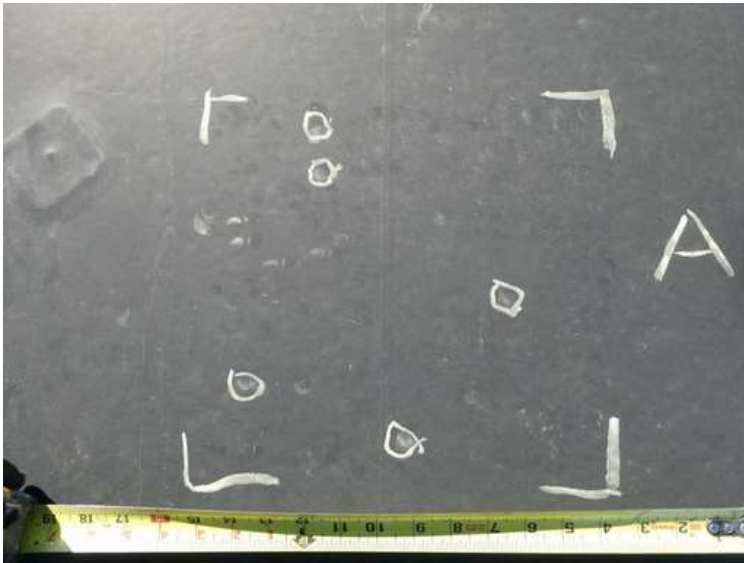
650. Building 26. Straight edge over a dent.



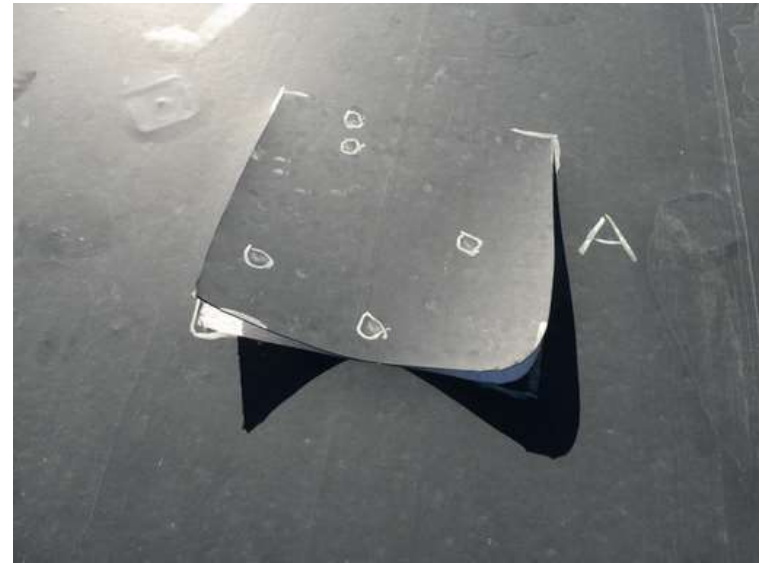
651. Building 26. Dent.



652. Building 26. Straight edge over the dent.



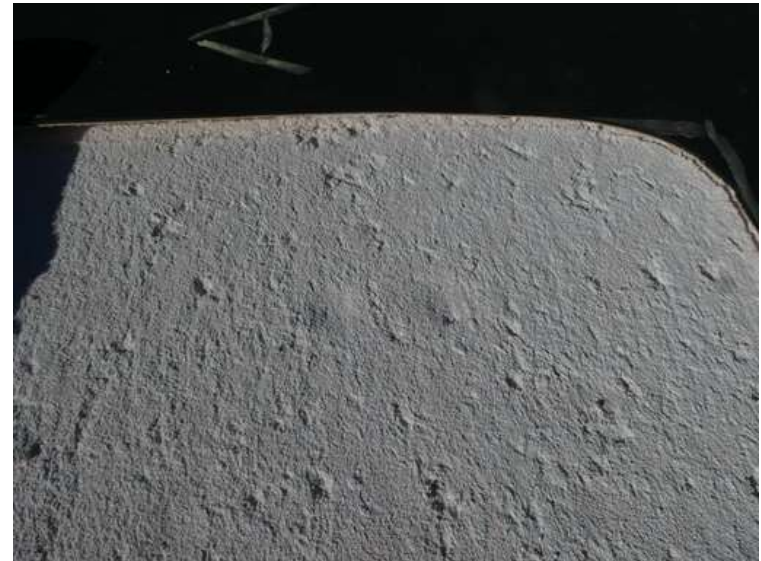
653. Building 26. Test area. Circular chalk marks denote dents from hail.



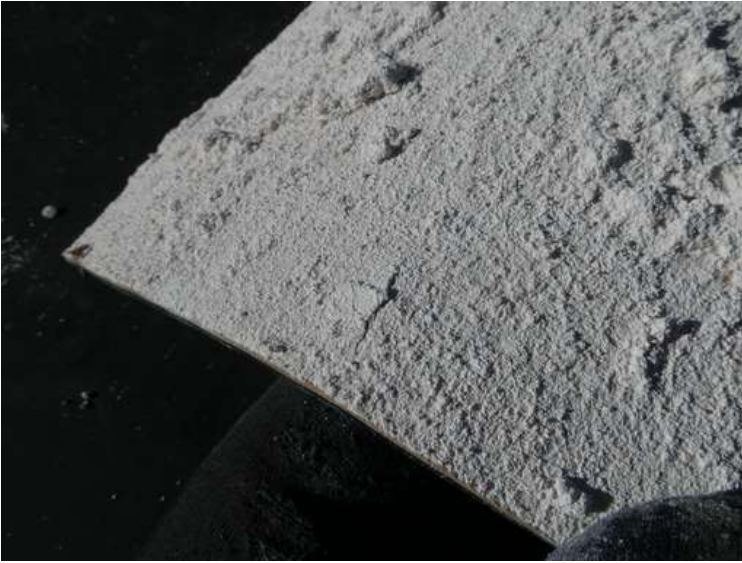
654. Building 26. Sample after cutting.



655. Building 26. Sample folded back. The gypsum substrate was dented.



656. Building 26. Dents from hail.



657. Building 26. Tear in the facer sheet from hail.



658. Building 26. Tear in the facer sheet from hail.



659. Building 26. The roof consisted of a plywood or OSB deck, a layer of gypsum board, and the adhered EPDM membrane.