Notes From the Commish

Winter of 2010-2011

By: Curtis Meskus, Building Commissioner/Zoning Enforcement Officer
building.zeo@townofcharlton.net

What a winter, snow three weeks in a row, with accumulation of two to three feet, ice dams on homes that have never seen ice dams before. Then the impending storm that broke and may break the camel's back. What went on? What caused the collapse of structures? What will happen because of the multiple collapses?

In Charlton we had failure of the gravity resistive system on eight structures of significance. Of the 4600 structures in town this number is 0.04% a statically small number, insignificant really unless the building was yours. State wide over 200 collapses were reported, some spectacular, but still well less than a one tenth of a percent of all structures.

Three of the structures that failed in Charlton, were structurally deficient from the day they were built, two lacked sufficient connections to resist the outward force of the roof at the ceiling line, they did not incorporate sufficient connections and the lack of sufficient ceiling joist allowed the lower corners of the roof triangle to fail. The third was portion of a barn roof that had less than ¼ of the needed strength in its roof structure then required by any code, how this roof lasted through the blizzard of 78 or the other major storms we have had, I do not know, maybe the warranty on the antigravity rafters ran out.

Another building that failed was in a state of disrepair and all readily in failure, its demise was not a surprise. Actually in my driving around, some of the buildings that one would expect to fail did not. As of this writing the cause and condition one building has not been determined due to its location.

The last two building were major commercial buildings, The first, had a manufactured truss roof, clear spanning 60 feet in the area of the building that failed, the remainder of the building has the same trusses spanning the same 60 feet but has partitions, that were designed to be non load bearing and may have taken on the load that kept that portion of the roof intact.

The second is a steel space frame structure, in which the horizontal purlins started to roll, once a member designed to be in a vertical orientation goes off that alignment it no longer has strength and buckles. The purlins in this building are connected together end to end; causing the whole rear roof purlins to roll over slowly over several days, with the demise of the building coming three weeks after the snow stopped falling.

Both of the commercial buildings appear to have been constructed in accordance with (IAW) the codes and loads required at the time of their construction, were they overloaded? I do not think the snow loads exceeded the 35 pounds per square foot (PSF), based on the actual weight of snow measured on two schools of 16 and 28 PSF, and the snow load on my roof of 10 PSF. There is the possibility that local snow and ice conditions could have exceed the design load in a specific area of these roofs. Other potential problems that could have lead to the failure of these

roofs systems are small defects in assembly or materials that over time have weakened the systems.

Notice I wrote systems, both of the commercial buildings had roof systems that are dependent on the sum of their components. Trusses are made up of small members in triangles the geometrically strongest shape. If one web or joint fails in a truss under heavy load the weight transfer to the adjoining members can cause those members to fail and the whole roof goes down like a row of dominos.

With a space frame building , some of the strength is derived from the skin holding the purlins in line and once some of the purlins started to roll, the skin attached to them pull harder on the adjoining purlins, more rolled until they buckled and pulled in the end wall on the building causing the roof to fail.

While the above scenarios for the cause of the collapse of the two roofs of the commercial buildings are plausible, it will be up to the insurance companies and the engineers to make conclusive determinations if they wish.

The question most ask of me is will the codes change next year because of the collapses? For sure the building industry will examine the requirements. The model and state code making bodies will and have all ready begun gathering data on the collapses, the insurance industry certainly has an interest in not paying out claims. The 7th and 8th edition of the Massachusetts commercial code have already upped the snow loads by approximately 25%. Remember that the updated codes only apply to building constructed after 2009 and buildings that are substantially renovated.

The ice dams affected many homes in town, until this year many had not had problems with ice and icicles forming, let alone water coming in to the home. Many have asked what the cause of ice dams is and what can be done to prevent them?

Let’s start with the cause of ice dams. When the underside of the roof is warm enough to melt the snow on the roof the problem begins. The snow itself acts as insulation trapping the escaping warmth from the home in the attic space, the snow melts and runs down the roof to the freezing roof edge, and ice starts to form. As the days progress the melting continues, more ice, then the ice builds up to the point the melt water cannot drip off the roof and backs up. The water then starts backing up under the shingles, trapped behind the dam of ice. When the insulation then gets wet, its R value is reduced and more heat is lost, accelerating the cycle.

What can prevent the formation of ice dams? Keep the snow from melting, how you ask, by keeping the attic at the same or below the outside tempeture. Or you can build what is called a hot roof, which is insulated to R-30 or more at the underside of the sheathing, think of a timber framed house with foam panels surrounding the exterior envelope of the home. A proper hot roof is not easily accomplished with fiberglass bats, but rather done with spray or sheet foam, densely packed cellulose or fiberglass.

More common is insulation at ceiling level, combined with attic ventilation. There are a few things to keep in mind. First, the insulation layer needs to be gap free, things like access hatches and pull down stairs need to have airtight seals and high R values, bathroom vents need to discharge to the outside and if possible not through the soffits, recessed lights are another source of heat and air leakage.

Second, ventilation needs to be maintained, to remove the warm moist air from the attic space. The most common arrangement on newer homes and homes that have been reroofed is a combination of soffit vents and ridge vents. Some homes have soffit vents and gable end vents, which don't work as well as the ridge vent and soffit, vent combination. Ridge vents and gable end vents do not play well together so this combination should be avoided.

This was an unusual year for this area, the three substantial storms in quick succession, building up over ridge vents, continued near freezing temperatures, lack of melting all contributed to the problems we had with ice.

OK you say, I have a new home, with ridge and soffit vents, why did get ice dams? Snow, really too much snow, two feet covering the ridge vent blocking the natural draft set up by convection of cold air entering the soffit vent and the relative warm air rising out through the ridge thereby keeping the attic cold.

Other things I see in newer homes that is increasing heat in attics are; the complicated roof lines making ventilation difficult and heating equipment, duct work and low R value, but code compliant insulation in the attic leaking heated air through joints and radiating heat into the attic space.

Things that are thought to stop or cause ice dams, but do not: Gutters, have nothing to do with ice dams, I have seen just as much ice on the roof edge with or without gutters. The application of self sticking rubber products under the shingles at the roof edge, these products may reduce water intrusion if installed far enough up the roof, but do nothing to stop the ice from forming. Aluminum ice belting along the roof edge, maybe, not guaranteed I saw a house with the ice belting on two roof edges, the south facing roof was clear; the north had ice six inches thick. Electric cables, maybe, if they are turned on before the ice forms and left on until all the snow melts off the roof.

Standing seam metal roofing seem to work by allowing the snow to slid off, but with that tons of sliding snow another set of potential problems occur, where does the snow land, on your head like the cartoon? Or the prized bushes?

As of the writing of this article, most of the roof snow has melted, spring is coming, repairs will be made to homes, and buildings will be rebuilt, plans reviewed and permits issued.

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