MUNICIPALITY OF ANCHORAGE

Development Services Department | Building Safety

Handout AG.30

Snow Removal Guidance

Buildings in Anchorage are required to be designed and constructed to support a minimum of 40 pounds per square foot (psf) snow load. The 40 psf snow load requirement dates back (at least) to the 1960s. We know, however, from numerous roof failures that many buildings in our community cannot safely support this much weight. Roof failures, including collapse, have occurred when roofs were supporting *substantially less* snow weight than the code minimum. These buildings were constructed prior to 1990 and generally have a wooden roof structure. Most failures involve wooden trusses with metal gang nail plates; however, other types of construction have had failures. These roof failures are primarily the result of design and/or construction deficiencies.

In addition to design and construction deficiencies, wood construction can lose strength over time. Since large safety factors are used in wood design, the loss of strength over time would typically be insignificant. However, if the construction is marginal or deficient to begin with, loss of strength can become relevant. Reasons for loss of strength include:

- Moisture content being either too high or too low.
- Wood subjected to long term loading loses a portion of its strength.
- Truss plates can loosen from cyclical loading, earthquakes and wood expansion/contraction caused by the seasonal movement of moisture.
- Rot from moisture damage. Note that wood rot can even compromise a robust structure.

The following guidance is intended to account for Anchorage's variable/aging construction.

Commercial buildings constructed prior to 1990 having wood roof trusses with metal gang nail plates:

- If these buildings have not been evaluated by a structural engineer, snow should periodically be removed from the roof throughout the winter to avoid a potentially hazardous accumulation.
- If a structural engineer evaluates the roof structure and determines it is capable of supporting the code minimum snow load, snow removal is not necessary, unless Anchorage were to receive an *epic* amount of snow.
- Some reasons why these roofs can be problematic:
    - Top chord bearing trusses were commonly manufactured in the 1970s and 1980s with a design flaw where the placement of the gang nail plates subjected the top chord to cross grain tension failure (the wood splits parallel to the grain).
        - As a minimum the plates should extend past the centerline and to within 2 inches of the top of the top chord.
    - Marginal or undersized gang nail plates are common in this era of construction. They can be problematic for the following reasons:
        - They can subject members to cross grain tension failure.
        - They do not account for manufacturer (installation) tolerances. The smaller the plate, the more important the positioning/seating of the plate. Trusses can have poorly positioned plates, and plates may not be completely seated into the wood.

        - They do not account for rough truss handling from the manufacturer to the job site and positioning the truss in place.
        - Gang nail plates have been observed *peeling-off* under-built (or over-loaded) trusses.
    - Inadequate (or no) truss bracing.

Carports.

- Anchorage has experienced a significant number of roof failures from improperly constructed carports.
- When in doubt, it is recommended that carports be structurally evaluated and strengthened accordingly.
- Carport supported by an adjacent structure: A common point of failure can be the ledger attachment between a carport and an adjacent building. This occurs when the ledger is not adequately attached to the building. If the ledger is just nailed (and not attached with lag screws), additional investigation and upgraded attachment is warranted.

Roofs subject to excessive ice damming:

- Many older buildings experience excessive ice formation on eaves and in low, poorly drained areas. The phenomena is commonly called ice damming (see Figure 1).
- Ice damming can cause water to pond to sufficient depth that it can enter the building causing water damage.
- Ice formation can overload structural elements.
- Ice can fall from the roof creating a hazard to people, pets, and property below.
- Ice damming is predictable – meaning if it occurred last year, it likely will occur this year, and so on.
- The most effective cure is to remove snow from the roof before it has a chance to melt and refreeze on the eaves.

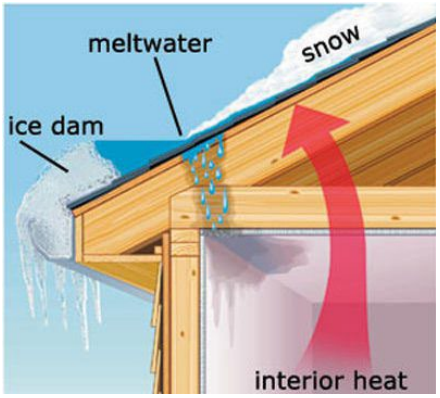

Figure A: Example of ice damming.

- Just clearing the eaves is typically not adequate because ice could be forming from snow melting on the entire portion of roof covering the heated space.
- Ice damming can be reduced by reversing the stack effect. In a cold climate, the stack effect causes air to enter a building low and leave the building high. Stack effect can be altered by mechanically exhausting air from the building, pulling the building negative relative to atmospheric conditions. It has been demonstrated through the AHFC energy upgrade program that continuously exhausting a home in winter can substantially reduce the accumulation of ice on eaves. In order to achieve this effect, the exhaust inlet should be located below the neutral pressure plane (where the pressure inside the house equals the pressure outside the house). Typically, this means one would want to locate the exhaust inlet in a crawlspace or first story of a multi-story house.

Falling Snow and Ice:

- Falling snow and ice has caused fatalities in Anchorage and represents a significant hazard.
- Metal roofs can avalanche the entire snow load in an instant, without warning. This typically happens on sloped (pitched) roofs when atmospheric conditions warm sufficiently to break the bond between the roof and snow.
    - Areas below downward sloped metal roofs require protection:
        - Install snow guards to retain snow on the roof, or
        - Block access to the area.
- Ice and icicles hanging over areas accessible to people and pets represent a significant hazard:
    - Remove the ice, or
    - Block access to the area.

Snow drifts:

- The requirement to design for snow drifting (see Figure B) first appeared in the 1988 Uniform Building Code, which was adopted by the MOA in January 1989. Hence buildings constructed prior to 1990 were likely not designed to accommodate the weight of snow drifts.
- Buildings constructed prior to 1990 should be periodically inspected for the formation of snow drifts. Snow drifting weighing more than 40 psf (which is roughly 2 feet of dense, wind-worked snow) should be removed, unless it can be demonstrated the roof is capable of supporting snow drift loading.

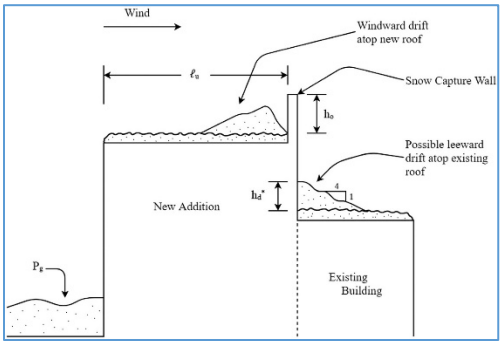

Figure B: Example of snow drift at roof parapet and at low roof.

Removal of snow and ice:

- Given the hazardous nature of working in high places, we recommend that professionals such as licensed/bonded roofing companies be consulted for snow and ice removal.

Ross Noffsinger

Ross Noffsinger, Acting Building Official
November 14, 2023