Winter Snow and Ice Loading

Winter can bring with it a heightened reminder of snow and ice problems. Snow and ice while driving and walking can present a very visible reminder of the hazards associated with cold climates. One hazard that can be overlooked during the cold winter months is the build-up of snow and ice on buildings that can create a variety of problems ranging from leaks to total collapse. With winter storms it is easy to experience a build-up of snow and ice that creates roof area loads that can easily overload a building's structural design limits and result in a catastrophic roof collapse. In addition to the potential for roof collapse, the weight of snow and ice and any resulting ice dams can result in water leakage under shingles and over flashings. Snow sliding from sloped roofs and skylights can injure pedestrians and drifting snow around buildings can limit access by people and emergency vehicles.

Factors Affecting Roof Loads

Snow loads on roofs depend on climatic variables such as the amount and type of snowfall, wind, air temperature, amount of sunshine, and on roof variables such as shape, thermal properties, exposure and surrounding environment. Knowledge of these variables and how they influence snow loads can help in evaluating the impact of snow loads.

Climactic Variations

The large variations in climates across the United States produce a wide range of snow types and accumulation patterns. Costal and great lakes regions can experience frequent thaws during the winter and are characterized by snow accumulations of varied duration, often produced by one or two snow storms only. Mountain states can experience the deepest snow accumulations which usually last the entire winter with a widely variable amount of snow accumulation.

The amount of snowfall and other climatic conditions can vary tremendously, making it difficult to generalize about snow loads on a specific geographic basis. Furthermore, there may be large variations in the properties of falling snow, ranging from dry and granular to wet and sticky, intermixed with precipitation such as rain and sleet.

Drifting

Of all the variables that influence snow loads on roofs the effect of wind is probably the most important. The snow accumulations on roof areas are particularly susceptible to drift action because of factors including exposed location and because wind speeds being greater than at ground level. As wind speed increases during a snow storm, more and more of the falling snowflakes are carried horizontally past exposed roof areas to those of lower wind speed areas where the snow can be deposited and accumulate in drifts. At wind speeds greater than about 12.5 mph, snow is picked-up from existing snow accumulations on roof areas and carried along the flow. This "scouring" action leads to removal of snow from some roof areas and can result in an accumulation in others such as the lower levels of multilevel roofs, valleys, and the downwind side of peaked and arched roofs. In addition, sometimes snow covers are affected by freezing rain or by freeze-thaw conditions that create a hard crust on the existing surface, making it essentially invulnerable to scouring or drifting but resulting in the build-up of weight on the underlying roof structure.

Various factors other than wind may modify the amount and distribution of snow that will accumulate on roof areas. In regions with mild winters or in late winter in colder regions solar radiation can effectively reduce snow loads by melting, particularly if part of a roof is bare and the surface is dark in color. Heat loss through the roof may also cause a significant reduction in the load, especially where the maximum load results from snow accumulations over a relatively long period. Many older roofs have been saved from collapse as a result of reduction of load due to melting.

Generally, snow load decreases as roof slope increases, mainly because the steeper the roof the greater the chance that some of the snow will slide off or blow away. The surface material has a considerable effect on the point at which friction is overcome and sliding occurs. Smooth surfaces such as sheet metal or glass have lower coefficients of friction than asphalt or wood shingles. In addition, heat loss through the roof may produce melting at the roof surface and thus, by reducing friction, initiate sliding.

Controlling the Weight of Ice and Snow

Two means of solving excessive snow load problems are to reinforce roof areas to handle large potential snow accumulation, or to remove the snow to maintain snow loads at acceptable limits.

If your buildings are showing any signs of structural overloading, an architect or structural engineer should be consulted. Repeated overloading of roofs can significantly weaken the roof structure over time. Your best insurance against structural damage from excessive snow and ice loads is to keep a watchful eye on your roof areas throughout the winter. Do not forget to check roofs for plugged drains and ice accumulation under the snow. Identify high risk building areas where snow can accumulate. Develop a specific list of roof areas to inspect throughout the winter to determine if any potential for collapse exists.

If you must remove the accumulated snow or ice from roof areas, the best strategy is to hire outside contractors to remove the snow. Hire professionals that can furnish you with copies of insurance certificates for General Liability and Workers Compensation coverage. When removing snow and ice, care should be taken to avoid damaging the roof covering including any membrane or flashing material.
