SNOW LOADING OF BUILDINGS AND STRUCTURES

INTRODUCTION

Most buildings and structures in snow prone areas are built to minimum design loads based on local building design standards.[1] Snow loading is only one of several loads that are incorporated into the design of a building or structure.

Severe damage could occur if the weight of the accumulated snow exceeds the design allowance. The snow load design takes into account:

- The shape, slope and profile of the roof;
- The texture/roughness of the roof covering;
- Whether the building is heated;
- An importance or occupancy factor;
- Any height differential between the roofs of the building;
- The proximity of other, taller buildings;
- The terrain.

In recent years, the number of building collapses has increased. In most cases, a new, higher roofed building had been built adjacent to, or within the drift pattern of, the existing building which was not reinforced for additional snow accumulation. The collapse usually did not occur within the first few years but occurred when the first heavy snowfall came and the winds blew the snow to the lower roof.

POSITION

When using any of these design standards, use the highest Risk Category, Working Life, or equivalent when designing essential buildings or structures. Buildings and structures that are not considered essential use a medium Risk Category, Working Life, or equivalent when designing the buildings or structures. Buildings and structures that are not in the highest or medium category use a low Risk Category, Working Life, or equivalent when designing the building or structure.

The following occupancies are considered highest Risk Category (IV) occupancy:

- Buildings and other structures designated as essential facilities such as hospitals and other health care facilities, power generating stations, public utilities, aviation control towers and centers, emergency aircraft hangers, and buildings that have critical national defense functions.
- Structures such as communication towers, fuel storage tanks, cooling towers, electrical substation structures, and water storage for fire-suppression equipment.
- Buildings and other structures, which would cause a substantial economic impact or disruption.
- Buildings and other structures, the failure of which could pose a substantial hazard to the community.
- Buildings and other structures that manufacture, process, handle, store, or use hazardous substances such as hazardous fuels, hazardous chemicals, or hazardous waste.

- Buildings and other structures that contain sufficient quantities of highly toxic substances.
- Building and structures that are critical to production or where there is interdependency with other facilities.
- Buildings and other structures required to maintain the functionality of the facility (boiler plants, water treatment facilities, warehouses storing dies and spare parts, etc.).
- Buildings and structures with high occupancy loads.

The following occupancies are considered medium Risk Category (III) occupancies:

- Building and structures that, if damaged, will not disrupt production.
- Office buildings where the occupants could work remotely if the building is damaged AND production is not disrupted.
- Warehouse buildings that are store noncritical products.

The following occupancies are considered low Risk Category (II) occupancies:

- Temporary facilities (erected for less than 60 days).
- Minor storage facilities.

DISCUSSION

The total snow load is the sum of the balanced snow load including partial loading, unbalanced snow load, drift snow load, sliding snow load, and a rain-on-snow surcharge. Each of these loadings must be calculated separately.

The balanced snow load on the roof depends on the amount of snow on the ground (ground snow load), a thermal factor depending on how well the roof of the building is insulated or if the building is heated, and an exposure factor depending on if the roof is exposed to wind that can blow the snow off the roof. The partial snow loading is a factor used to cover any drifts on the roof due to parapets and small items installed. The unbalanced snow load is the roof is on a slope and the wind will blow off the snow near the ridge and having it collect near the eave.

Drift snow loads need to be calculated when there is a large obstruction such as a cooling tower or tank on the roof or higher part of the building such as an elevator penthouse. Sliding snow loads are calculated on lower roofs where the snow from a higher portion of the building could slide off onto the lower roof.

When the roof is relatively flat, a rain-on-snow surcharge might be added to the snow load because the water tends to remain in the snow much longer and not get to the roof drain system.

REFERENCES

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