Managing heavy snow loads on roofs

CFPA-E Guideline No 5:2020 N

CFPA EUROPE

FOREWORD

CFPA Europe develops and publishes common guidelines in order to achieve similar interpretation in the European countries and to give examples of acceptable solutions, concepts and models. CFPA Europe has the aim to facilitate and support fire protection, security and protection against natural hazards.

The market imposes new demands for quality and safety. Today, fire protection, security and protection against natural hazards form an integral part of a modern strategy for survival, sustainability and competitiveness.

These Guidelines are primarily intended for the public. They are also aimed at rescue services, insurers, consultants, safety companies and the like so that, in the course of their work, they may be able to help manage risk in society.

These Guidelines reflect best practice developed by the national members of CFPA Europe. Where these Guidelines and national requirements conflict, national requirements shall apply.

This Guideline has been compiled by the Natural Hazards Group and is adopted by all members of CFPA Europe.

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Jesper Ditlev
Chairman

Cologne, August 2020
CFPA Europe Guidelines Commission

Hardy Rusch
Chairman

Contents

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1. Introduction

In some parts of Europe roofs collapse every year because of heavy snowfalls, and heavy snow load. Besides that problem a lot of snow and hail can also produce ice dams on the roof, which can cause a different kind of damage. The problems with snow and ice might increase because of climate changes, and in some parts of Europe the weight of snow on roofs is one of the leading causes of quality degradation and roof collapse. So it is important to take steps to protect buildings from the risk of snow and ice. The likelihood of heavy snow is increasing if heavy snow and snow storms are followed by frequent periods of melting giving wet snow. Removal of such wet snow should be the highest priority. Buildings need to be constructed in accordance with the building regulation in each country with the definition of minimum requirements, but even if that is done the snow load can nevertheless be too big. Flat roofs and also complex roof geometry, the roof components, e. g. sky lights, roof drainage, and if present, roof-mounted equipment, can give an extra risk that the snow and ice will exceed the loadbearing capacity. Many roofs carry a montage of sun panels, etc. on the roof, something that has been put there long after the construction of the building. In general the montage should preferably avoid the accumulation of snow as much.

The measures of Natural Hazards Guidelines concern not only operators, businesses, specialists and plant officers, but also to population and local administration. This is due to the fact that in contrast to fire, the impact of natural hazards is often very widespread.

2. Scope

This publication on protection against heavy snow is the one of a series of guideline published by CFPA Europe which addresses various types of natural hazards. These recommendations are applicable to all types of buildings that are built in those areas where snow falls. The building owner and operators, manufacturers, planners, professional staff for construction works and facility management services all need to be supported in their actions. The Guideline gives recommendations on how to prepare before the winter season, how to remove the snow, and on protecting measure for the snow season. Roof construction design is not the topic of this Guideline, since these requirements are already considered in the Construction Codes of each country.

3. Preparing for the winter

Snow load is the downward force on a building's roof by the weight of accumulated snow and ice including hail. It is the weight, not the depth of the snow, which is cause for concern. Light and fluffy snow has a very low weight, packed snow has a higher weight, and moisture laden snow is very heavy. The removal of wet snow should be of highest priority.

The risk for moisture and heavy snow is increasing if snowing follows by frequent periods of melting. Such changes in weather will results heavy snow and ice on the roof. A lot of snow is heavy, but together with ice and water it can be very heavy indeed. Depending on the building age, type of roof and other design parameters, excessive snow, moisture laden snow, and ice can cause roof collapse and other serious property damage. Ice can quickly accumulate,

blocking roof drains. The weight of snow and ice can easily overload a roof above its design parameters and result in collapse. The following best practice will help you to avoid such situations:

- You need to know how much snow your building can safely handle. Building regulations (codes) are different between countries in Europe. Requirements have changed over the years and that can result in different or weaker constructions. Regulations (codes) are normally created to protect human life, and not to prevent or to limit property damage. If you are not sure you can contact a structural engineer to determining the snow load design.
- New roof additions after design and construction of the building can change the snow bearing potential. If something has been added to the roof, the weight results in a lower tolerance for heavy snow. Montage on roofs such as new roof covering, antenna, solar panels and suspended equipment inside the buildings, etc. are also a critical factor and should be considered.
- When you are determining the maximum permissible snow load, you need to take into account both roof additions and the additional loads of persons and equipment for snow removal.
- Eliminate the conditions that make it possible for dams to be formed. Well insulated attics help to prevent the melting and freezing cycle that cause ice dams to form.
- When replacing a roof, you should install a water membrane underneath the roofing cover, e. g. shingles. It will act as an extra barrier that helps water from seeping inside.
- Roof can have some damage or corrosion and inspection every year is recommended. Gutters and roof drains should be checked every year to ensure that they are not blocked. Ice accumulation along the eaves is a contributing factor to roof collapse. Repair any damage.
- Make sure that gutters are clear before the winter season starts.
- Make sure that gutters stay free of ice; special heating systems might be necessary.
- Make sure that insulation is intact before winter sets in, to prevent snow and ice resulting in water leaks in the house.
- Windows and doors should be checked every year, because change in their operation can be a good indicator that the foundation of the building are moving, this can lead to a higher risk for roof collapse due to constructional deformations.
- Make sure that the roof space including needed connecting routes and workplaces for snow removal can be safely entered; this is best achieved from the stairs but can involve a platform or scaffolding on the façade.
- In case of large-scale roofs, suitable discharge points around the building should be determined in advance, which should be kept clear during snow season. Herewith the snow removed from the roof can easily be carried away from the premises and some interference of normal and safe operation can be avoided.

Figure 1 A montage of photovoltaic panels on the roof together with a lot of heavy snow can easily overload a roof above its design parameters and result in collapse. Photo: GVD, Germany

4. Develop plans

Prepare a plan if the building is located in an area with heavy snowfalls and if there is a risk for roof collapse because of heavy snow.

- Prepare for the worst case and develop plans to protect your building and equipment, e.g. an action plan, which includes definition of thresholds corresponding to factors such as depth of snow, monitoring and actions, etc. and a business continuity plan (see also CFPA-E guideline No 2).
- Goods and equipment need to be protected. Have a sufficient number of tarpaulins available or have plans to store them in a safe building nearby.
- Identify shut-off valves for utilities, such electricity and water.
- Eliminate all sources of ignition if the automatic sprinkler system needs to be turned off.
- A snow removal plan should be reviewed by a structural engineer and roofing contractor to ensure that it does not increase the hazard of collapse or cause damage to the roof covering and is conducted in a manner that is safe for the workers on the roof.
- Evaluate yearly the effectiveness of the plans and make necessary adaptation.

5. Protecting measures during the winter season

Emergency situations can arise with heavy snowfalls, and it can be necessary to take immediate action. Action is recommended e.g. for premises accommodating a lot of people if the roof has a free span structure exceeding 10 meter, and at the same time the snow load exceeds half of the design parameters.

- Monitor roof conditions related to the necessary stability under snow load and monitor snow and ice accumulation across the entire roof including critical spots.
- Remember that wet snow and ice are far heavier than fresh light snow; the visible depth of snow may be deceiving.
- When it is still safe, implement the plan for snow removal and monitor snow depth on roofs (Note: Snow load can be measured manually as well as automatically by proven suitable sensor. It is in this connection also important to pay attention to the location and number of measuring points).
- If you are clearing roof from snow yourself, you need appropriate equipment specifically designed to roof working. Remember to put safety first any time you are on the roof, especially when the roof is covered in snow and ice. Have someone outside with you for possible case of an accident. If you have any doubt or when clearing snow from the roof of a multi-story building, you should leave it to the professionals.
- Remove snow down to the point there is still a couple of cm left on the roof. Scraping the roof clean can reduce the expected lifespan of the roof surface.
- Decided where snow is placed when removing it from the roof. Do not block building exits. Do not bury equipment such as fire department connections, hydrants, sprinkler, gas and other utility valves. Do not place piles where melting snow can cause seepage or flooding inside the building.
- Keep eyes open for damp spots or areas of discoloration on walls and ceilings inside the building.
- Take special care, if the power supply line is mounted with an antenna to the roofing. Due to higher standing on snow, you might get to close to high-voltage electricity unknowingly!!
- Remove an ice dam from the roof by trying to knock the ice dam off with a roof rake or cut a channel through the ice to allow standing water to drain. Another method is to fill a nylon stocking with calcium chloride ice melt and place it vertically across the ice dam so that it melts a channel through the dam. Remember that use of rock salt directly will damage the roof.
- Large icicles can pose a danger to people when they fall off. Try to safely knock the icicles off
- Be aware of any warning signs that the building structure may be under significant stress and perhaps in danger of collapse. The obvious sign that the roof is about to give way is sagging. Inspect interior structural members for any sign of deflection or cracking. Inspect walls and ceilings for sign of cracks that have recently developed. Look for cracked or broken windows. Inspect and test doors and windows, to see that they operate as designed. Look for any sprinkler heads that are pushed down and leakage from roof-suspended piping. Listen for any unusual creaking or popping sounds. If you hear creaking, cracking or popping sounds, you should get out of the building immediately.
- Signs of deflection or damage to buildings structure should immediately be inspected. Evacuation of the building or temporary shoring may be warranted. Shutdown of sprinkler systems, etc. may be advisable roof collapse is likely.
- Implement emergency plans if collapse is imminent or has occurred.

Figure 2 Damage because of heavy snow load can result in very high cost. Photo: Breda Dušič Gornik/Dolenjski list

6. Safe removal of snow

In general, a steep roof will simply force snow to fall off the side of the house as there will be no flat surface to carry it. However a steep roof presents a higher risk of injury to individuals who are working on the roof to clear snow. Before attempting to remove snow from roofs, take note that clearing roofs can be a dangerous task. It shall be ensured that qualified and trained personnel perform the removal of snow and all safety features for working at heights are implemented. Arrange the snow removal in time, especially in case of a persistent snowfall, because the necessary staff and appropriate equipment are not always immediately available.

- A monitoring system helps you to determining when it's necessary to start snow removal, e.g. by continuous measurement of the roof deflection or recurring weighting of the snow trepanning,
- The maximal snow height, at which the removal of snow must be initiated, e. g. 40 cm in Sweden, should be determined depending on the site-related design load for snow, because the specific weight of snow can vary between 50 and 400 kg/m^3 and be further increased by icing.
- Once snow build-up occurs or ice dams form, using a roof rake is the best option. The rake has an extended handle, which enables you to pull snow off the roof from the safety of the ground.

- The use of snow shovelling can result in damage to the roof surface or to installations at the roof and creates therefore other problems, e.g. loss of the water tightness of the roof waterproofing system or damage to the lightning protection device. Use an aluminium scoop shovel to clear the roof.
- To remove snow and ice, start from the edge and work into the roof using downward strokes.
- Watch out for ice hanging off the edge of the roof.
- When clearing snow from a multi-story home it is best to hire professional contractors.
- Decide if you will remove the snow or if you should hire a contractor to perform the work. Enter into a written contract with a contractor to make sure they can response quickly to your call.
- If using a contractor you need to make sure they have proper insurance and also check their references

7. After snow storm

Follow up directly after a snow storm:

- Inspect your property for damage.
- Prepare for the next storm and if necessary make changes to the plans.
- Report any damage and claims promptly to your insurance company.

8. Insurance

Check with the insurance company to:

- Confirm that your property insurance covers roof or building failure due to snow load.
- Make sure the policy pays for actual replacement costs.
- Verify that valuable equipment is covered under a property endorsement.

9. CFPA-E Guidelines

Fire

Guideline No.01: 2002 F	Internal fire protection control
Guideline No.02: 2013 F	Panic & emergency exit devices
Guideline No.03: 2011 F	Certification of thermographers
Guideline No.04: 2010 F	Introduction to qualitative fire risk assessment
Guideline No.05: 2003 F	Guidance signs, emergency lighting and general lighting
Guideline No.06: 2011 F	Fire safety in care homes for the elderly
Guideline No.07: 2011 F	Safety distance between waste containers and buildings
Guideline No.08: 2004 F	Preventing arson – information to young people
Guideline No.09: 2012 F	Fire safety in restaurants
Guideline No.10: 2008 F	Smoke alarms in the home
Guideline No.11: 2005 F	Recommended numbers of fire protection trained staff
Guideline No.12: 2012 F	Fire safety basics for hot work operatives
Guideline No.13: 2006 F	Fire protection documentation
Guideline No.14: 2007 F	Fire protection in information technology facilities
Guideline No.15: 2012 F	Fire safety in guest harbours and marinas
Guideline No.16: 2008 F	Fire protection in offices
Guideline No.17: 2008 F	Fire safety in farm buildings
Guideline No.18: 2013 F	Fire protection on chemical manufacturing sites
Guideline No.19: 2009 F	Fire safety engineering concerning evacuation from buildings
Guideline No.20: 2012 F	Fire safety in camping sites
Guideline No.21: 2012 F	Fire prevention on construction sites
Guideline No.22: 2012 F	Wind turbines – Fire protection guideline
Guideline No.23: 2010 F	Securing the operational readiness of fire control system
Guideline No.24: 2010 F	Fire safe homes
Guideline No.25: 2010 F	Emergency plan
Guideline No.26: 2010 F	Fire protection of temporary buildings
Guideline No.27: 2011 F	Fire safety in apartment buildings
Guideline No.28: 2012 F	Fire safety in laboratories
Guideline No.29: 2013 F	Protection of paintings: Transport, exhibition and storage
Guideline No.30: 2013 F	Managing fire safety in historical buildings
Guideline No.31: 2013 F	Protection against self-ignition and explosions in handling and storage of silage and fodder in farms

Guideline No.32:	2014 F	Treatment and storage of waste and combustible secondary raw materials
Guideline No.33:	2015 F	Evacuation of people with disabilities
Guideline No.34:	2015 F	Fire safety measures with emergency power supplies
Guideline No.35:	2017 F	Fire safety in warehouses
Guideline No.36:	2017 F	Fire prevention in large tents
Guideline No.37:	2018 F	Photovoltaic systems: Recommendations on loss prevention

Natural hazards

Guideline No.1:	2012 N	Protection against flood
Guideline No.2:	2013 N	Business Resilience – An introduction to protecting your business
Guideline No.3:	2013 N	Protection of buildings against wind damage
Guideline No.4:	2013 N	Lightning protection
Guideline No.5:	2014 N	Managing heavy snow loads on roofs
Guideline No.6:	2016 N	Forest Fires
Guideline No.7:	2018 N	Demountable / Mobile flood protection systems

Security

Guideline No	1:2010 S	-Arson document
Guideline No	2:2010 S	-Protection of empty buildings
Guideline No	3:2010 S	-Security systems for empty buildings
Guideline No	4:2010 S	-Guidance on keyholder selections and duties
Guideline No	5:2012 S	-Security guidelines for museums and showrooms
Guideline No	6:2014 S	-Security guidelines emergency exit doors in non residential premises
Guideline No	7:2016 S	-Developing evacuation and salvage plans for works of art and -heritage buildings
Guideline No	8:2016 S	-Security in schools
Guideline No	9:2016 S	-Recommendation for the control of metal theft
Guideline No	10:2016 S	-Protection of business intelligence
Guideline No	11:2018 S	-Cyber security for small and medium-sized enterprises