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Addressing Your Building's Winter Blahs

Each year, winter brings freezing temperatures, snow, and ice to many parts of the country. We respond by grabbing our coat, gloves, and snow shovels. As much as we are aware of how the changing weather affects our daily activities, we must also remember the impact severe weather has on the built world.

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For building owners and maintenance professionals, winter often brings many unique challenges not experienced during warmer months. Here are five common winter challenges to consider while servicing your building or structure this winter.

Condensation

Under any weather condition, water vapor in the air travels from warm, humid air to cold, dry air. As exterior temperatures drop and the building heating system begins operating, building envelopes begin to experience changes in air and vapor movement. The warm humid inside air drives toward the colder, dryer exterior. If the warm humid air contacts cold surfaces, such as un-insulated window panes or thermally bridged frames, condensation can occur. Unaddressed condensation can result in water-related damage to interior finishes and, in extreme cases, organic growth. There are many tools available to properly diagnose the factors leading to condensation issues (e.g., infrared thermography, thermal analysis, and temperature and humidity monitoring). Proper diagnosis of these factors help determine the level of effort recommended for addressing condensation issues, which can range from simple adjustments to interior conditioning parameters up to intrusive system retrofits. See Figure 1.

FIGURE 1

Snow accumulation

Roof structural systems are designed to support loads due to self-weight of the structure as well as from service loads such as wind and snow. For many structures located in cold climate zones, the most significant roof loading is from heavy or uneven snow accumulation. When deterioration or deficiencies exist in a roof structural system, distress or even failures are more likely to occur during such snow loading events. Roof structures are generally designed in a manner to exhibit significant visible effects of overloading prior to catastrophic failure. During large snow events, observable signs of roof structure distress may include cracking or displacement of rigid interior finishes or displacement exposed structural members beyond those expected under normal building movements.

Freeze-thaw cycles

Cyclic freezing and thawing is a commonly encountered mechanism of deterioration for exposed building materials such as masonry

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Building's Winter Blahs (CONTINUED)

FIGURE 2

FIGURE 3

FIGURE 4

or concrete. When water absorbed in materials is exposed to freezing temperatures, the water freezes and expands. During warming periods the water thaws and mobilizes. Repeated cycles of freezing and thawing of the water in the materials can result in deterioration (e.g., spalling and cracking) that can affect aesthetics, material strength, and structural stability. In many cases, freeze-thaw deterioration is related to ineffective or failed water management components or systems. Solutions to freeze-thaw deterioration should look beyond the resulting effects of deteriorated materials and focus on the wall or roof system in its entirety. See Figures 2–3.

Corrosion

De-icing salts, particularly sodium chloride, are often utilized on sidewalks and roadway surfaces to reduce ice accumulations. Where unprotected, mild steel or iron elements (e.g., handrails, embedded concrete reinforcing steel, doors) exposed to salt-laden water will result in accelerated and aggressive corrosion. De-icing salts can be mobilized by water and water droplets in the air and may reach areas that are not adjacent or near the application area. Due to expansive behavior of steel during the corrosion process, distress in the adjacent materials often results, including displacement and cracking. Ongoing corrosion of steel members when left untreated can result in loss of section of the steel element. The best approach for controlling corrosion at prone areas is to limit the amount of exposure to de-icing salts, particularly sodium chloride. Where de-icing salts are necessary, selecting less corrosive alternatives to sodium chloride is preferred. Routine cleaning to remove corrosive salt deposits from susceptible metals can also reduce the detrimental effects of de-icing salts.

Ice damming

Snow accumulation on roofing systems without adequate insulation can result in ice damming. When under insulated, the roof is warmed by interior heat, causing snow in contact with the roof surface to melt. As the melted snow drains and migrates to colder areas of the roof, typically at the eaves, the water re-freezes, creating an ice dam. If unaddressed, these buildups of ice prevent water from adequately draining off the roof, often leading to water penetrating to interior spaces through material and system defects. If water infiltration or damage is observed during the winter months, particularly near roof edges, this may be an indication of ice damming. Infrared thermography is a useful tool for identifying warm areas in the roof surface where supplemental insulation materials may be warranted to mitigate factors leading to ice damming. See Figure 4.

Extreme winter weather conditions expose buildings and structures to conditions not typically encountered during the remainder of the year and can create maintenance challenges. It is important to be aware of warning signs of the developing or ongoing issues to promptly mitigate these issues, as early detection and attention often equates to less costly repairs.

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