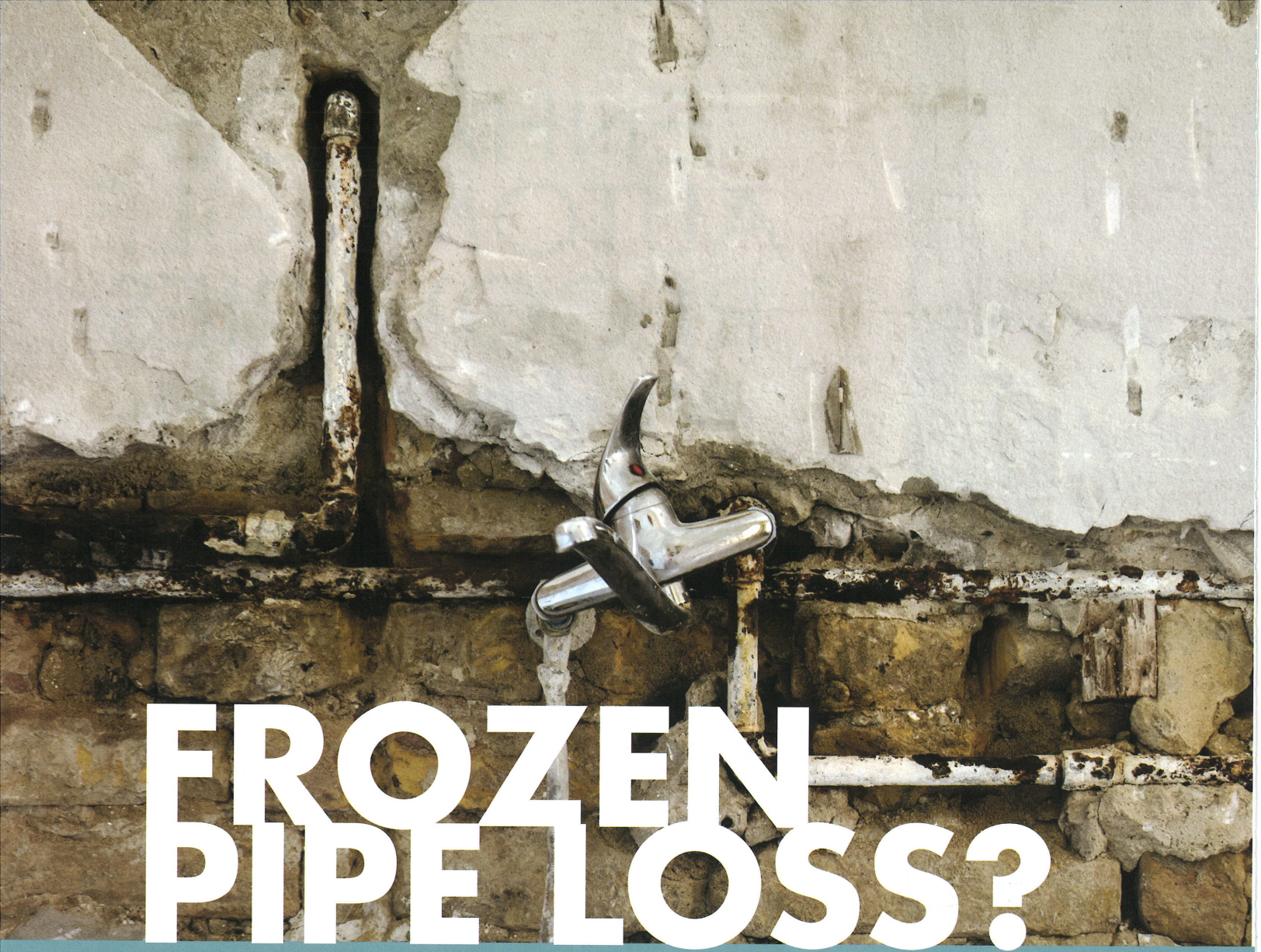

FROZEN PIPE LOSS?

Why It Happens and What Investigators Look For

BY PETER CHEN, ARCCA, INC.

FALL is the season when most of the country begins their preparations for winter. But of all the preparations we do, such as clearing leaves from gutters, roadways, and storm drains, one of the most important is to prepare our heating systems for the colder weather so that the comfort level we've become accustomed to in the occupied spaces of our buildings and homes is maintained throughout the winter. That comfort level can typically be defined as a space that is sufficiently heated and dry.

Buildings and homes generally have many water-based systems that need to be kept above freezing in order to operate properly and not fail. Typically, at a minimum, our buildings and homes will have a potable water supply (for drinking and cooking) and a sanitary water supply (for washing and lavatory functions), along with either an independent or a unified drainage system. Additionally, in the northern climates, buildings and homes may have closed-loop hot water or steam systems used to create heat via fuel gas furnaces. They may also have fire sprinkler systems, either wet or dry, that are water-based, as well as additional accessory closed-loop hot water systems for built-in floor heaters. There may also be other outdoor water systems requiring cold weather maintenance, such as faucets, lawn sprinkler systems, in-ground or above-ground pools or hot tubs, wells, and septic tanks and drain systems.

Plumbing system failures are one of the leading sources of residential water losses, with almost 20% of these losses being caused by frozen pipes. For large building or commercial losses, frozen pipe water damage can have a domino effect, resulting in property losses to adjacent properties either bordering or below, as well as business interruption losses. When those buildings also contain computers or electronic data, there can be a catastrophic and irrecoverable loss of data, information, or programming.

Frozen pipe and water damage, if uncontained, can also domino into damage to other building systems, including electrical, heating/HVAC systems, or transport systems (elevators or escalators). These other systems have components that are likely located at the lowest level of the building (basement or sub-basement). External to the building or home, frozen pipe and water damage, if uncontained, could result in personal injury or motor vehicle accidents, as water freezes in unintended locations such as sidewalks or roadways.

Plumbing system failures are one of the leading sources of residential water losses, with almost 20% of these losses being caused by frozen pipes.

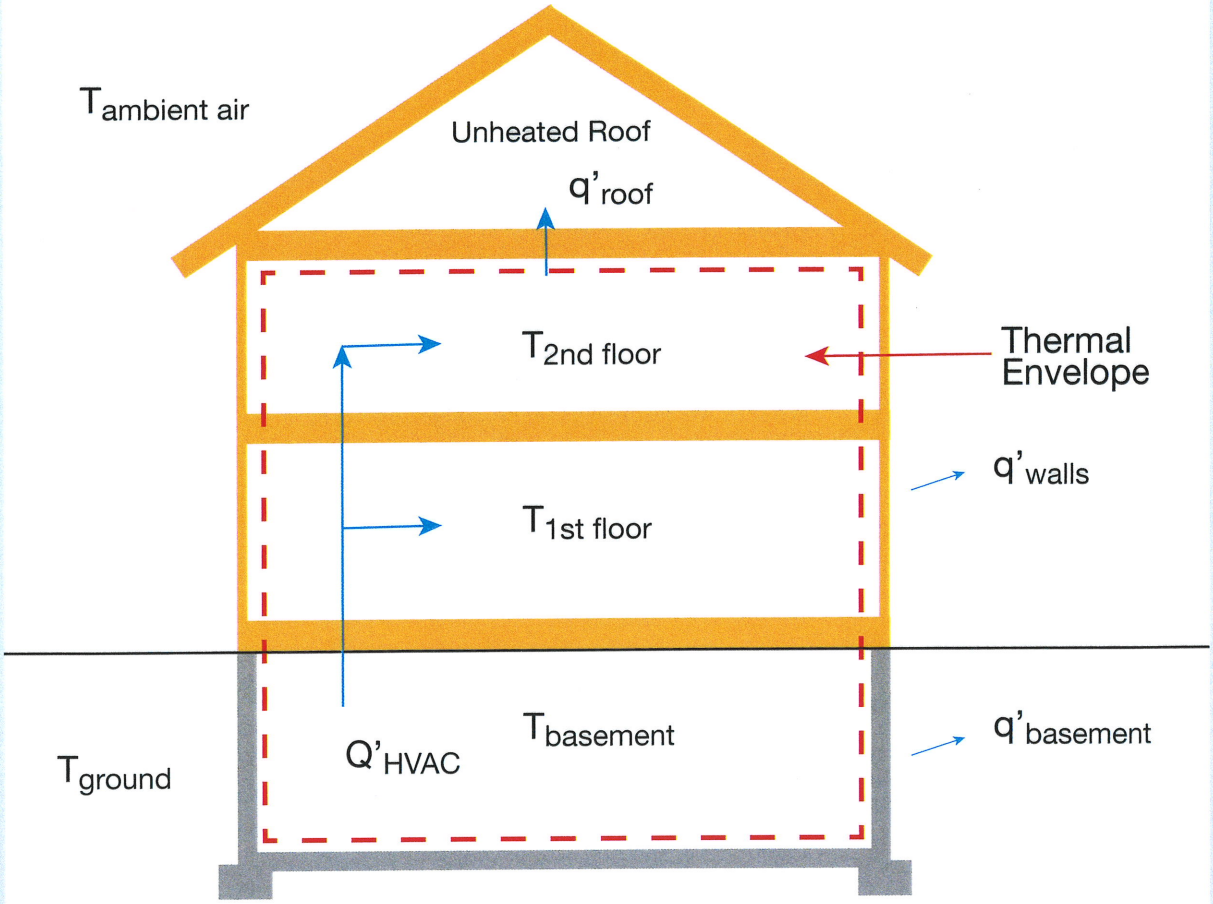

FIGURE 1: Example of Thermal Envelope, Temperatures, and Heat Transfer

THERMAL ENVELOPE

To understand how a building is typically designed to prevent frozen water pipes, we need to discuss the thermal envelope. The "thermal envelope" is the space within a building that would be considered conditioned and protected from the outside environment. The thermal envelope may be conditioned directly with a Heating, Ventilation, or Air Conditioning (HVAC) system, or indirectly. Indirect conditioning can occur if an unconditioned space (no direct heating, venting, or a/c) is sufficiently surrounded by directly conditioned areas (for example, a storage closet). Indirect conditioning can also occur if the space is below grade, with limited penetrations or exposure to the exterior environment, and surrounded above by conditioned space. Indirect conditioning may also occur in spaces where there might be mechanical equipment, HVAC equipment, or other devices that create heat or forced air flow.

In order to prevent frozen water pipes, water-based systems are typically placed within the thermal envelope of the building. Thermodynamically, there is a balance between the heat loss from the thermal envelope (by conduction and convective heat transfer) and the heat generated by the HVAC system (or other building systems) that results in different temperatures throughout the thermal envelope (See example in Figure 1).

The objective of a good building design is to keep the temperatures throughout the thermal envelope above freezing for predicted ambient air temperatures and thermodynamic conditions (wind and convective heat transfer predictions), so that none of the water systems within the building will freeze.

For unoccupied/empty buildings or external/outdoor water systems, they can be protected by location (deep in the ground), insulation, or active heating systems (i.e. electrically heated or thermal tape/wrap). Or, exposed water systems can be winterized by draining the water from the pipes and systems, and/or filling the system's components with anti-freeze.

FROZEN WATER OR PIPE INVESTIGATION

Frozen water or pipe damage can have many root causes. Investigating them typically requires a site inspection of the building in the damaged state. However, it is understood that, for frozen pipe damages, a quick response and timely repair are required in order to return the building to its operational condition and to prevent subsequent water damage effects (i.e. mold). In the absence of inspecting the site in its damaged state, an inspection of the site in the repaired state, plus a review of the documentation of the damaged condition and building systems may be all that is available to the investigator.

An investigation should include researching the history of the building to understand when the HVAC and building systems were last altered or repaired, and whether maintenance of those systems was being performed. Researching the building's history may also uncover the original construction condition and any subsequent changes, as well as any additions or alterations to its water-based systems.

The investigator should also research the weather history for the area where the building is located. Analyzing both the weather and the building's history might reveal whether the frozen water or pipe damage incident was a one-time, isolated event due to unpredicted and extremely cold and windy weather, or a repetitive event wherein frozen pipes were a regular occurrence whenever the weather reached a certain condition.

Researching any changes in how the building's HVAC or other systems were being used is also beneficial to the investigator. For example, frozen pipes could be the result of the building's owner lowering the thermostat in order to reduce heating and energy costs. A history of the building's electrical, fuel gas, or fuel oil records should be obtained by the investigator to determine any changes in use.

In summary, the key to successful recovery in frozen pipe claims is a thorough investigation into not only the facts immediately surrounding the incident, but a full history of the building in question.

For unoccupied/empty buildings or external/outdoor water systems, they can be protected by location (deep in the ground), insulation, or active heating systems.