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Infrared and the Building Envelope

A building's "envelope" includes the roof, ceiling, floors, walls, windows, skylights, slab edges, and below-grade walls. One of the prime functions of the building envelope is to keep water from entering or accumulating inside the building. When the envelope fails to perform this job, the stage is set for an escalating series of problems that can lead to significant energy losses, substantial structural and interior damage, mold growth, and occupant discomfort and illness. Infrared thermography of the building envelope is the most comprehensive and inexpensive way to locate sources of moisture and mold problems and guide cost-effective repairs.

Roof Leaks...or Bypasses?

Because the various components of the building envelope work together as an inter-related system, it can be difficult to determine which component is failing when problems arise. We were recently asked to locate the causes of moisture problems at a manufacturing facility. The facility manager reported that the roof was leaking, but only during the winter.

Infrared testing revealed that the broad surface of the metal roof was cold, while the roof ridge vent was unusually warm. Our interior investigation pinpointed numerous bypasses where warm moist air from the building was flowing up into the roofing system. This moisture condensed on the underside of cold metal roofing, where it would freeze. During warmer weather the ice would melt and "rain" would occur inside the building. Although the immediate assumption had been that the roof was leaking, infrared testing revealed a much less costly problem. Applying sealant to the warm air bypasses quickly and inexpensively solved the customer's moisture problems.

Water infiltration of the building envelope can be both a direct and indirect cause of moisture problems inside the building. In addition to its potential to immediately damage structural components, inventory, and equipment, water seepage raises interior humidity and drastically reduces the performance of insulating materials. In turn, heat losses through water-damaged insulation create cold spots in the envelope, where airborne moisture can readily condense to water.

Pinpointing Causes of Ice Dams

Infrared thermography is also an excellent tool for detecting the underlying causes of ice dams. Ice dams occur when excessive heat loss through the roof system melts snow accumulated on the roof. When the melt water reaches a colder area of the roof, it freezes and forms a "dam". Ice dams can cause extensive damage to roofing and wall systems, creating yet more opportunities for water to enter the building.



Ice dams are often caused by excessive heat losses near the eaves.

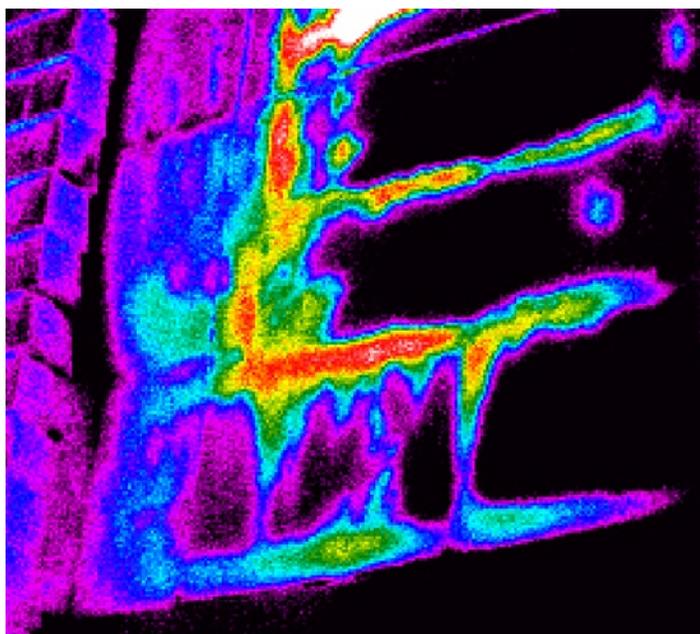
Mold cannot grow without moisture, and eliminating moisture problems is the first and most cost-effective step in the effort to prevent mold growth on building surfaces. While infrared testing does not directly identify mold, its ability to reveal the conditions that support mold growth makes it a highly cost-effective “first line of defense” in any comprehensive plan for addressing and preventing mold.

A Proactive Approach to Mold Prevention

Last summer, a northern New England school district was plagued by a serious mold infestation. After spending \$4.5 million on mold remediation and building renovations at their elementary school, the district decided to adopt a proactive approach. Our firm was called in to perform an infrared roof moisture inspection in order to locate areas of leakage and potential mold sites in the flat roofing system of the high school. We located 39 small water-damaged areas in the roof. Armed with this information about the root causes of their problem, the school district is now moving aggressively to repair these areas and eliminate the possibility of further mold infestation.

A Proactive Approach to Mold Prevention

Professional building envelope thermographers can pinpoint and document a variety of common sources of water infiltration, including aging and poorly fitting window and door seals and panel gaskets, as well as poorly performing ar-



Thermography is an ideal tool for isolating water-damaged areas in EIFS systems.

chitectural details and construction techniques. Newer construction technologies can present additional challenges in the ongoing struggle to keep water in its place. Exterior insulation and finish systems (EIFS) may absorb water through joints and through breaches in the finish. Thermography is ideally suited to locate faults in these and other exterior finish systems.

Many of the moisture problems we see today are not new to the construction industry. However, the increased emphasis on insulation and air tightness has made controlling them far more critical to maintaining the health of the structure – and its occupants. Fortunately, infrared thermography provides an outstanding tool for early detection and resolution of these and other building envelope problems.

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Peter Brooks has more than forty years of experience with facilities, including fifteen years in residential and commercial construction and contracting. A Certified Thermographer with over twenty-five years experience providing infrared services, Brooks is a recognized expert in Nondestructive Testing who has trained thermographers at the national level in the methods and techniques of infrared testing. Mr. Brooks is president of Infra-red Analyzers of Williston, Vermont.

