The Use of Infrared Thermal Imaging in Indoor Environmental Investigations

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ABSTRACT

Infrared thermal imaging has been increasingly used to identify wet building materials that can be sources of mold growth and degraded indoor environmental quality. However, infrared cameras are also an important tool in the evaluation of HVAC (heating, ventilating, and air conditioning) systems, which are the primary pathways for the distribution of contaminants in a building. Through identification of temperature differentials, infrared cameras can be used to pinpoint areas of unwanted pressurization or depressurization within a building, negative pressure indoors with respect to outdoors, and problems with HVAC system components. Infrared cameras can be used to rapidly identify areas of concern so that an in-depth evaluation and corrective action can be taken to correct degraded indoor environmental quality.

Keywords: indoor environmental quality, HVAC, contaminants, infrared, thermal imaging

INTRODUCTION

Infrared thermal imaging has been shown to be a useful tool in the detection of unwanted moisture that can lead to degraded indoor environmental quality (IEQ). It is also a useful technique in rapidly evaluating the temperature differentials associated with HVAC systems and building air pressures that can be the transportation pathways for indoor contaminants associated with IEQ problems.

MOISTURE INTRUSION AND WET BUILDING MATERIALS

Figure 1 is the IR image and photo showing water intrusion into the wall and carpeting from a plumbing leak within the wall cavity.

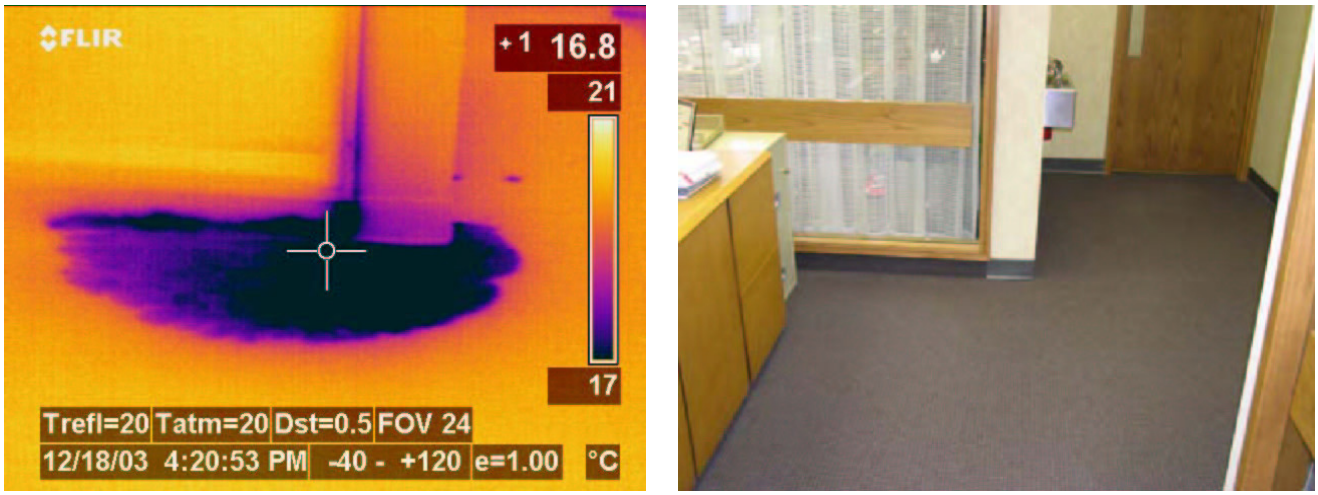

Figure 1. Thermogram/photo showing water intrusion from plumbing leak inside wall behind fountain

FAILURES IN THE BUILDING ENVELOPE

Figure 2 is the IR image and photo showing water intrusion into the basement that was obscured by the fireproofing. Failures in the sealant in the sill plate were identified that were resulting in the entrance of water and uncontrolled air into the building.

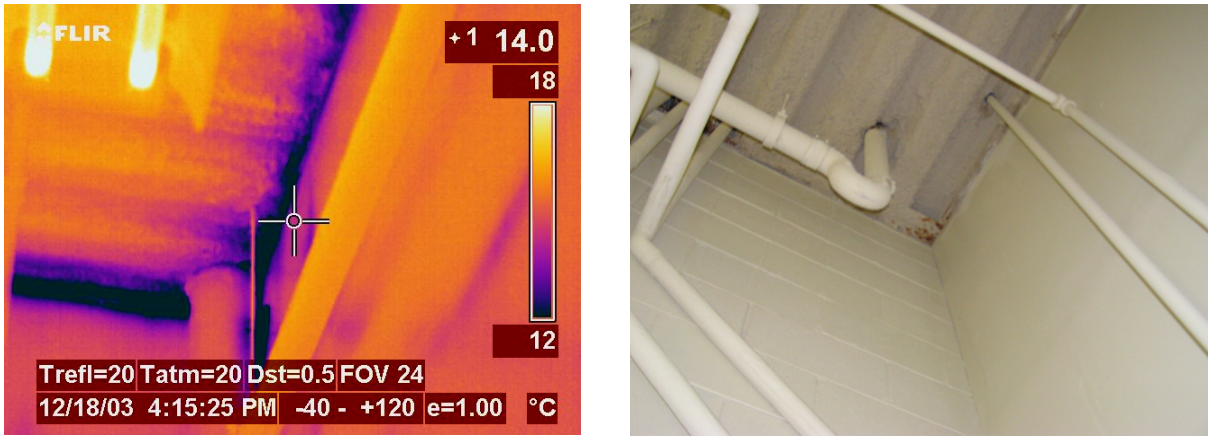

Figure 2. Thermogram/photo showing water intrusion into basement due to failure in sealant of sill plate

Figure 3 is the IR image and photo from the grade level of the exterior of the building. Failures in the sealant were identified through the IR pattern of heat loss from indoors. The air pressure inside the building was negative, and this failure was an entry point for uncontrolled air.

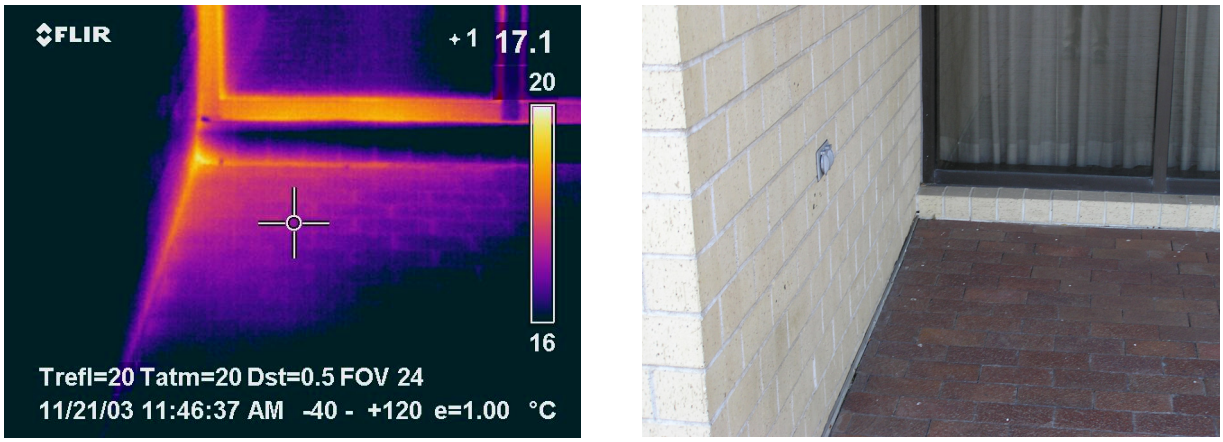

Figure 3. Thermogram/photo showing loss of heat from inside building due to failure in sealant

BUILDING AIR PRESSURES

Figures 4 and 5 are the IR images and photos showing the entrance of uncontrolled cold air due to the unbalanced operation of the HVAC system, which resulted in a negative air pressure inside the building with respect to outdoors.

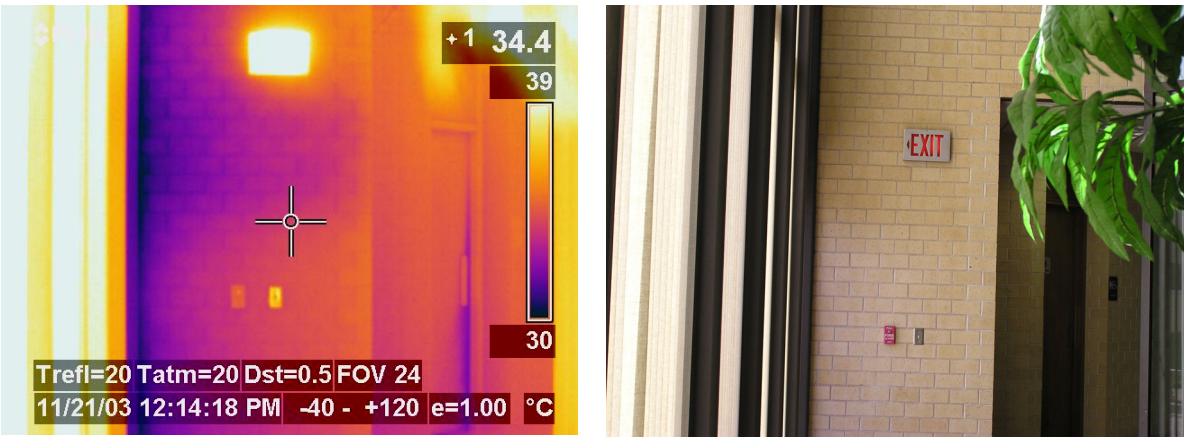

Figure 4. Thermogram/photo showing entrance of uncontrolled cold air due to negative air pressure inside building from unbalanced operation of HVAC system

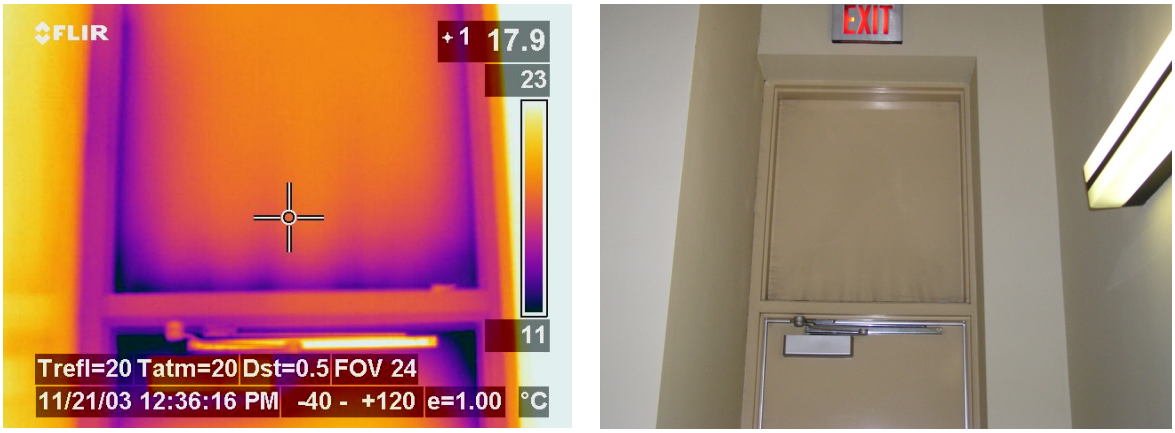

Figure 5. Thermogram/photo showing entrance of uncontrolled cold air due to negative air pressure inside building from unbalanced operation of HVAC system.

Figure 6 is the IR image and photo showing temperature differentials resulting from cooler air from the plenum space entering the occupied space. This indicates that the plenum space is under positive pressure with respect to the occupied space due to the unbalanced operation of the HVAC system.

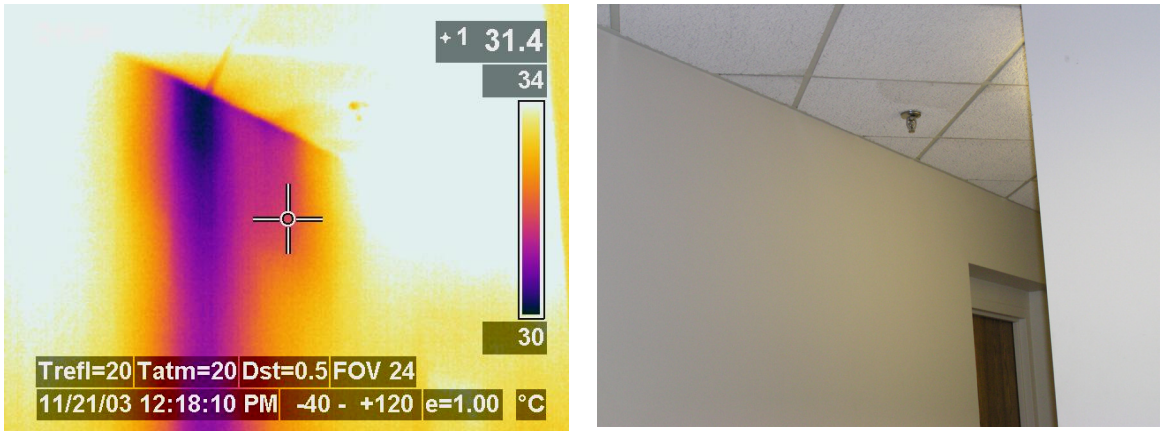

Figure 6. Thermogram/photo showing entrance of cooler air from plenum due to positive air pressure in plenum from unbalanced operation of HVAC system

HVAC SYSTEM COMPONENTS

Figures 7-9 are the IR images and photos showing IR thermal imaging used to illustrate air flow from HVAC system components.

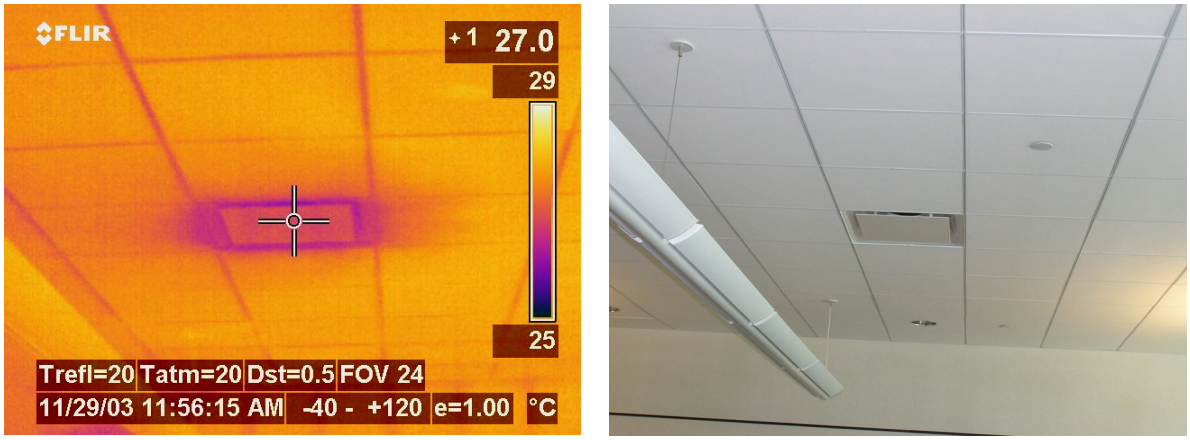

Figure 7. Thermogram/photo showing uniform air distribution pattern from supply register

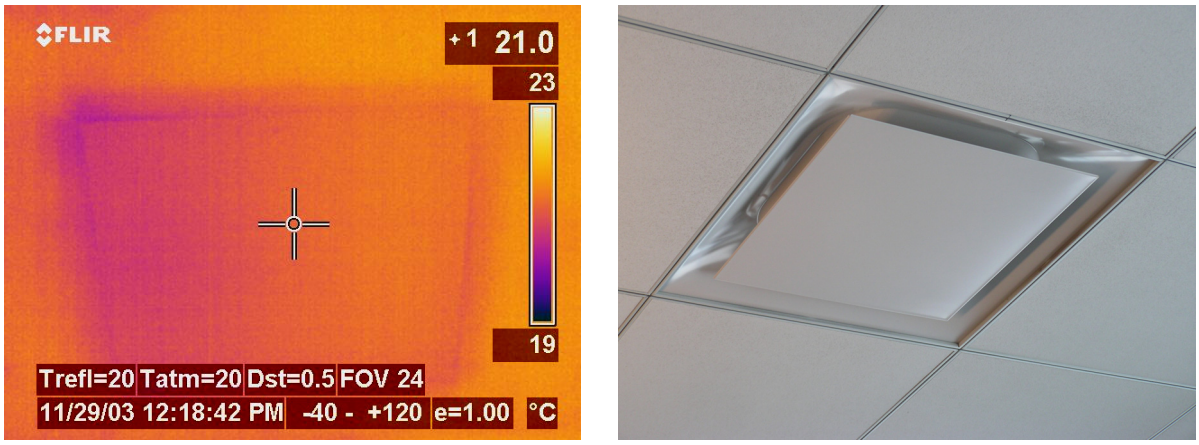

Figure 8. Thermogram/photo showing non-uniform air distribution pattern from supply register

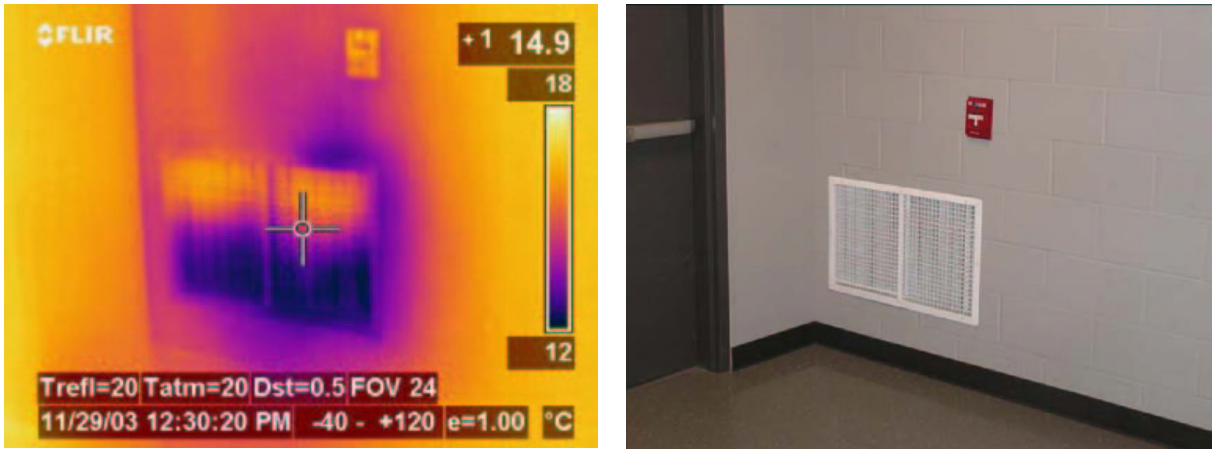

Figure 9. Thermogram/photo showing non-uniform air distribution pattern from supply register

SUMMARY

IR thermal imaging is a useful tool in the rapid determination of moisture intrusions, building envelope failures, building air pressures, and air flows. These parameters are important factors to consider when evaluating indoor environmental quality.