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By Peter Brooks-Vector mapping: A new forensic tool for identifying building envelope problems

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A building's "envelope" physically separates the building's interior from its exterior environment, and includes the foundation, roof, walls, doors and windows. A sound building envelope keeps water from entering or accumulating inside the building and prevents excessive amounts of air and heat energy from escaping. When the envelope fails to perform either task, the stage is set for an escalating series of problems that can cause significant energy losses, substantial structural and interior damage, mold growth, occupant discomfort and illness, and litigation.

Vector Mapping Eliminates Guesswork

When there is an active roof leak or water intrusion, the low-slope roof system should be thoroughly investigated to locate and eliminate all sources of water leakage. Until recently, only indirect, hit-or-miss methods were available to verify the integrity of installed roofing membranes. With a new electronic leak detection technology called Vector Mapping, it's now possible to positively identify all the breaches in a roof system, even those invisible to the naked eye. Compared to traditional methods of visual inspection and flood testing, this breakthrough technology saves building owners and managers significant risk, time, and money.

Vector mapping pinpoints leaks by tracing the flow of an electric current across the surface of the roof membrane. Because vector mapping detects membrane faults directly, repairs can be made on the spot and immediately retested to ensure watertight results.

Vector mapping can be performed using either low or high voltage equipment. In low voltage vector mapping, the surface of the roof membrane is moistened (not flooded) to create an electrically conductive medium. A conductive wire loop is laid out on the membrane around a section of the area to be tested. Leaks are detected when the electric current flows across the moistened membrane and down through the breach to the roof deck, completing a circuit. Our technician uses two probes connected to a vector deflection indicator to determine the direction of the electric current and precisely locate the breach.

High voltage Vector Mapping is conducted on dry horizontal or vertical surfaces using a small current at relatively high voltage for safe and reliable testing. As the technician sweeps an electrode brush over the membrane surface, electricity will flow through any breach in the membrane, completing a circuit between the brush and the roof deck. In either method, membrane areas that are sound will act as an insulator and prevent the flow of current to the deck, thus verifying membrane integrity.

Infrared Pinpoints Air Leaks

In most cases, air leakage through the building envelope is the largest source of energy loss and occupant discomfort. A report by the National Institute of Science and Technology (NIST) found that air "infiltration in commercial buildings can have many negative consequences including reduced thermal comfort, interference with the proper operation of mechanical ventilation systems, degraded indoor air quality, moisture damage of building envelope components and increased energy consumption." (1)

Leaking air escalates the "stack effect", convection-generated air movement inside buildings that increases with the difference between indoor and outdoor temperatures. With a leaky building envelope, stack effect causes drafts and erratic indoor temperatures and can make some zones difficult or impossible to heat comfortably.

Significant faults in a building's envelope can often be pinpointed with infrared thermography. Finely calibrated heat-seeking infrared cameras, sometimes supplemented with blower door testing, will reveal details of the building's thermal performance in "real time". Our experienced Certified Thermographers and analysts use the data generated to identify the most appropriate and cost-effective measures to solve building envelope problems and slash client energy costs.

Professional application of developing technologies like Vector Mapping and Infrared Thermography give contractors, architects, engineers and building owners more accurate information about building performance while reducing troubleshooting, repair, and energy costs - a win-win for everyone concerned!

Notes:

1. Investigation of the Impact of Commercial Building Envelope Airtightness on HVAC Energy Use
S. J. Emmerich, S. J.; McDowell, T.; Anis, W. NISTIR 7238; June 2005
www.fire.nist.gov/bfrlpubs/build05/PDF/b05007.pdf

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