

The background of the cover is a photograph taken from a rooftop, looking out over a dense city skyline. In the foreground, there's a dark, wet surface, possibly a pool or a large water tank, which reflects the buildings and the sky. A metal railing runs across the middle ground. The skyline is filled with various skyscrapers and buildings, with a few prominent ones standing out against a clear blue sky. The overall tone is professional and urban.

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NONDESTRUCTIVE TESTING

Electronic Leak Detection
Infrared Thermography
Leak Detection Capabilities
Frost Surveys

MOTHER NATURE

offers alternative to

TRADITIONAL NDT ROOF MOISTURE SURVEYS

BY DONALD KILPATRICK



Overall of a fairly large anomaly in a built-up roof assembly.

The roofing community, building owners, consultants and contractors can all benefit from roof moisture surveys that are provided at no cost by Mother Nature.

There are a number of recognized methods available to determine and, in some instances, quantify the extent to which moisture has infiltrated a roof system. NDT, or non-destructive testing of roof systems for the presence of moisture, is an important element of the total roof management package. Used properly, NDT testing methods can identify relatively small areas of moisture-laden materials. Through roof management—which includes annual moisture surveys—defective membrane and other potential sources of moisture entry can be identified and appropriately repaired. The importance of this type of service cannot be understated. The ability to essentially “look into a roof system” and determine the presence of moisture is of mutual benefit to building owners, roofing contractors, and consultants. An undiscovered defect in the membrane can result in significant leakage and damage to existing insulation that perhaps could have been salvaged in conjunction with scheduled reroofing. Prudent building owners should require those providing roof management services to have the resources to implement some form of roof moisture survey.

The equipment and expertise commonly associated with NDT roof moisture surveys are usually in the hands of those engaged in and promoting themselves as roof consultants. A well-done survey can be a powerful tool that provides meaningful data useful in establishing annual budgets and projected costs for reroofing and repairs. Maintenance programs can also benefit from this type of survey. Small pockets of wet insulation can be easily located, economically removed, and replaced, thereby extending the service life of the existing roof system. On occasion, when the majority of the insulation is found to be in good overall condition, these isolated pockets of wet materials can be removed and replaced in conjunction with scheduled reroofing. The balance of the dry materials can then be salvaged, significantly lowering reroofing costs.

The type and frequency of moisture surveys are driven, to a degree, by imposed budget limitations and the types of roof systems encountered. For example, it is not likely that a building owner would be interested in sponsoring an infrared scan of a facility every six months. A roof moisture survey should be performed at least three times during the projected life of the roof system. Once installed and put into service, roof systems are largely forgotten and expected to perform faithfully until their

pre-determined life cycle has been exceeded or water entry occurs.

Roof moisture surveys, as well as cursory reviews of roof system conditions, can give new life to the warranties offered by some manufacturers. If the installed roof system is represented by such a warranty, it should serve as a reminder, if nothing else, that it is a sustainable asset that requires a standard of care and occasional maintenance. Obviously, the review should be conducted prior to the expiration date of the implied warranty. In addition to the manufacturer's warranty, some consultants require that the installer provide workmanship warranties with varied terms and conditions. If, for example, an owner holds a five-year workmanship warranty sponsored by the installing contractor, it would be a good idea to conduct a roof moisture survey in the fourth year of service. At a minimum, subsequent surveys should be considered in three to five year increments throughout the life of the roof system.

As previously mentioned, the specialized equipment required to perform NDT roof moisture surveys is typically in the hands of a roof consultant. Most building owners are not in a position to commit funds and do not have the skilled manpower or equipment required to fulfill this need through an "in-house" approach.

The generally accepted methods for conducting roof moisture surveys are infrared, nuclear, and capacitance. Regardless of the method employed, the interpretation of the data by qualified personnel is necessary for a successful survey.

In the northern two-thirds of the contiguous 48 states, Mother Nature warns us of the advent of winter with an occasional hard frost. After a clear, cool night, it can be expected that you will wake up to a blanket of frost covering everything from your windshield to your favorite perennials. While

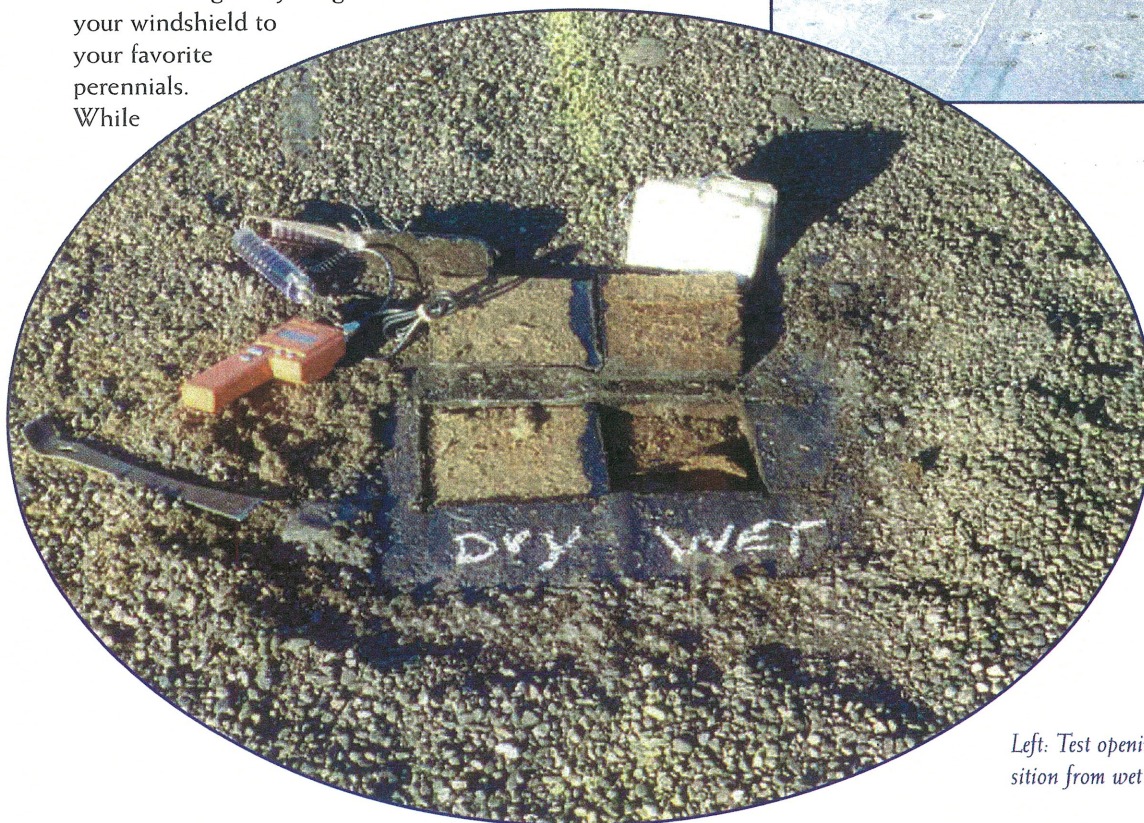
you're saddened about the change in the climate, it presents an opportunity to conduct free NDT roof moisture surveys.

The principle is similar to that of the infrared scan. Wet insulation in the roof system retains heat either from solar gain or heat loss from the building interior. The temperature differential between the wet and dry insulation components is readily discernible with the infrared equipment.

The method presented herein is referred to as a "frost scan" and is best suited for hot mop-applied and adhered roof systems. In the early morning, under the right conditions, it is not unusual to see the aforementioned blanket of frost covering the roofs on all types of buildings. When the surface of the roof is cooled uniformly to the temperature below that of the outside, or ambient dew point temperature, the formation of the frost layer will result. Frost will not form on the areas of wet, warmer insulation or those areas where the roof surface was not cooled to below the ambient dew point temperature. The observed anomaly can be easily traced with marking paint or lumber crayon on the roof



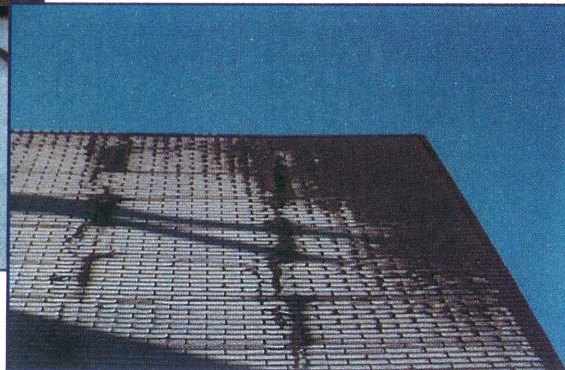
Above: The fastener pattern and frequency are demonstrated by heat loss in the frost on this adhered EPDM.



Left: Test opening made at the transition from wet to dry materials.



Below: Frost patterns here clearly demonstrate the problems related to an unvented, single layer of insulation in a sloped roof configuration.



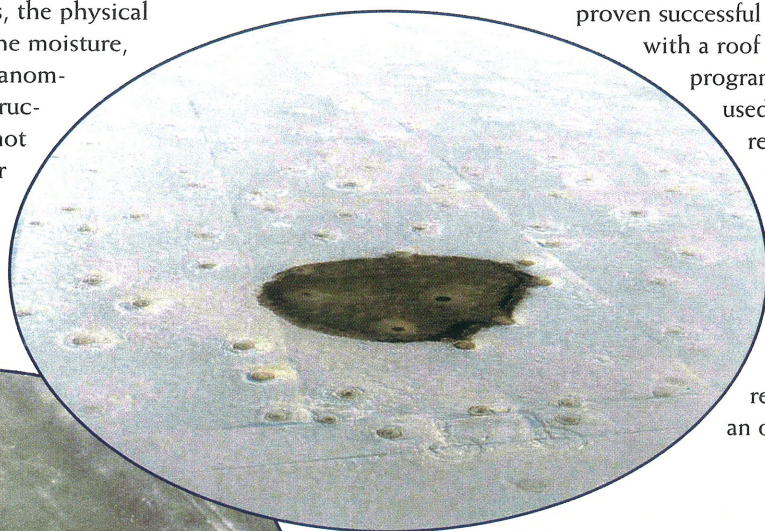
Above: A small anomaly in the foreground, drain sump, and larger anomaly in the upper right corner were found on these roof areas.

surface for future reference. In some instances, the physical damage to the roof membrane, or source of the moisture, is easily identified within the confines of the anomaly. To address potential warranty issues, destructive confirmation or moisture probes should not be executed without the consent of the owner and the potential involvement of the installing contractor.

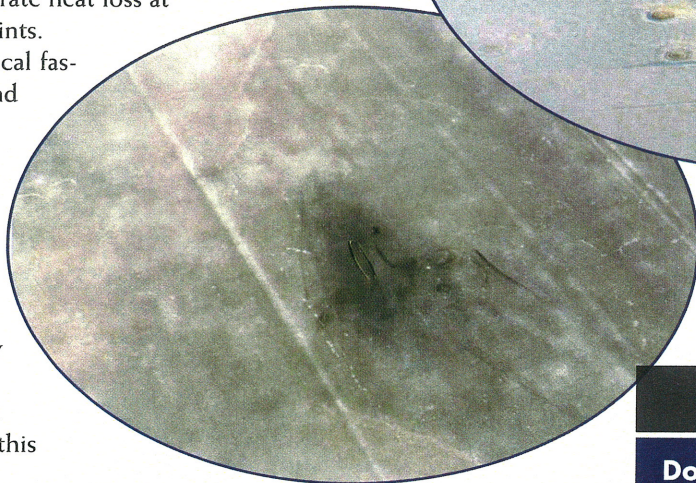
Through this method, other roof system features may become evident. Roof systems with a single layer of insulation will often demonstrate heat loss at board joints. Mechanical fasteners and drain sumps, representing heat transfer and heat loss, may also be observed through this process.

In summary, building owners interested in maximizing the service life of their roof systems are most likely to benefit from this practical knowledge. They are in the best position to have staff at the right place, at the right time, to take advantage of the opportunity presented. The individual performing the visual survey needs to be aware of the potential for false returns as a result of below-deck conditions relative to heat sources and the hazards inherent in walking across a roof covered with frost. The frost scan has

proven successful when interfaced with a roof management program and can be used to determine replacement quantities when the design criteria suggest that salvaging existing, sound insulation during scheduled reroofing may be an option. ■



Above: Close up of the smaller anomaly.



Above: The physical damage that was centered in the anomaly.

ABOUT THE AUTHOR

Donald Kilpatrick began work at INSPEC, Inc.'s Minneapolis, MN, office in 1985 and has been involved in all aspects of roof consulting. His duties include roof system design, construction observation, roof evaluation, and forensic evaluation. Don is a professional member of RCI, a member of RCI's *Interface* Peer Review Committee, and serves on ASTM Committee D-08.



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