

Roof Moisture Surveys: An Effective Tool for the Industry

By Karl A. Schaack, P.E., RRC

When properly implemented, non-destructive moisture surveys can provide a valuable benefit to all parties involved in the industry. The main purpose of a moisture survey is to document the condition of the roof substrate materials (i.e., insulation board, absorptive decking material) or identify the extent of moisture infiltration within a roof system.

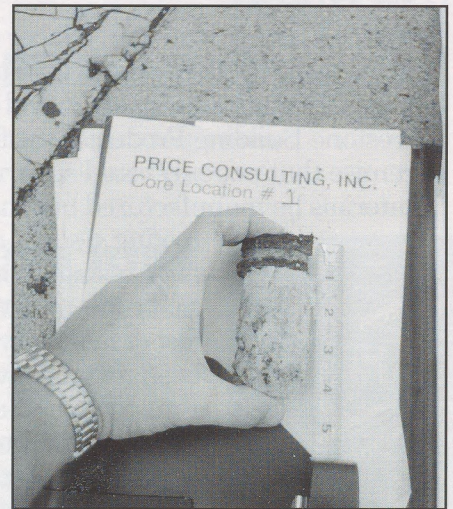
Non-destructive moisture surveys can be performed utilizing one or more of the following techniques: infrared thermography, nuclear moisture meter technology, or capacitance moisture meter technology.

Infrared thermography basically identifies thermal anomalies located on the roof. These thermal anomalies are often associated with roof substrate materials which have retained moisture. During warm weather, "wet" substrate materials will retain a greater amount of heat compared to adjacent "dry" materials. After the heat source is removed (following sunset) and the surface of the roof cools, infrared cameras can detect the "heated" wet substrate materials. During cold weather (winter months), infrared cameras can detect interior heat that transfers through the "wet" substrate materials due to the reduced thermal resistance. Infrared thermography can be accomplished utilizing hand-held equipment or equipment that is mounted on aircraft. Aerial thermographic surveys can provide a "quick" assessment of numerous roofs or a large roof during a single night's survey time. However, these surveys have limitations on

small roofs or roofs clustered with a significant amount of roof-top equipment. In addition, roof-top access is still necessary in order to verify findings and "questionable" areas. With hand-held equipment, basically every square foot of roof area can be surveyed. Actual boundaries or delineation

between "wet" and dry areas can be readily identified and documented. The survey team personnel can instantaneously verify findings of the thermal scan. This level of survey is limited by the capacity of the survey team in relation to site conditions. In addition, this type of survey (whether hand-held or aerial) has to be performed at night.

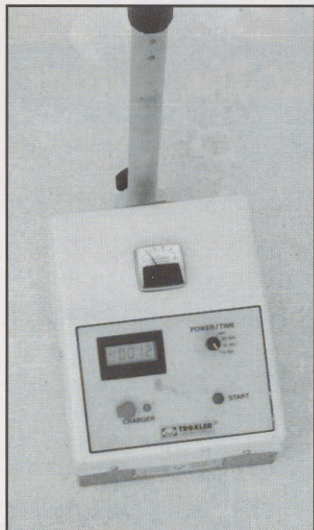
The basis of the **nuclear moisture meter** relates to recording the level or amount of hydrogen atoms located within the roof system. A small radioactive source within the meter emits neutrons when the meter is engaged. These neutrons react with hydrogen atoms located within the roof assembly and are backscattered. The meter records the number of backscattered neutrons. The greater number of backscattered neutrons recorded typically indicates a larger presence of hydrogen atoms, found in water. Performing this type of survey involves recording meter readings obtained on a grid (5' x 5', 10' x 10') placed on the roof surface. Once the readings are obtained, a statistical analysis is performed of the readings in order to



Roof core confirmation of construction and condition.



Suspected "wet" area delineated on the roof surface.



Typical moisture nuclear gauge.

obtain suspected “wet” and “dry” readings. Confirmation of the condition of the insulation (via cores) at the various meter readings is essential to provide more precise data. Upon determining the wet and dry readings, the quantity and extent of the affected areas are extrapolated between the grid points. This type of survey is timely and can be performed at any time of the day. The findings can be considered “limited” as the identified “wet” area boundaries are based on

estimations and not actual findings.

The technology of a **capacitance meter** is based on dielectric constants of materials. Most materials utilized in roof construction have a much lower dielectric constant than water. Therefore, as moisture within the substrate materials is encountered, higher readings are recorded on the meter. A grid survey similar to that utilized for a nuclear gauge can be implemented. A mobile or rolling model of the capacitance meter is available which can be readily transported across smooth-surfaced roofs to survey the entire roof area. If a grid-type survey is utilized, confirmation of the roof components and extrapolation of the findings are performed. A special model of capacitance meter is manufactured to be utilized specifically on EPDM roofs. This survey can be performed at any time, with its major limitation being the presence of moisture on the surface or within the membrane which may “mask” the actual condition of the underlying materials.

These surveys can provide an added value to all those involved in the roofing industry, from the contractor to the architect to the building owner, during various phases of the roof, including new construction, annual maintenance, and condition evaluation.

New Construction

A moisture survey can be beneficial in several facets during the construction of a new roof. During construction/roof installation, if water infiltration into the building interior occurs or is suspected, a moisture survey can provide an assessment of the actual moisture migration, if any, that may have occurred. This survey can be very beneficial in aiding respective parties in resolving disputes regarding actual damages. After completion of the new roof, a moisture survey can be performed to document any possible areas of water infiltration that may have occurred during work activities and to provide a “baseline” of the condition of the roof substrate materials for the start of its new “life.”

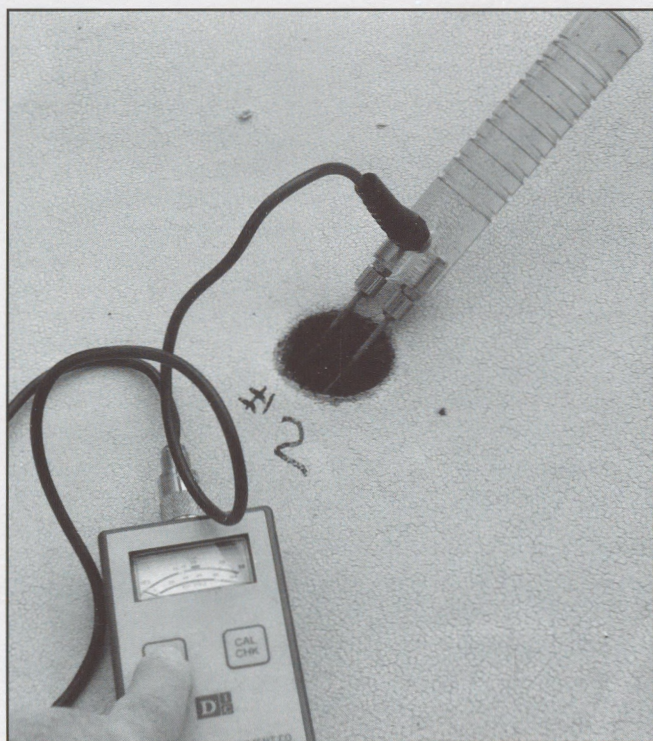
Roof Maintenance

After the roof is installed, roof moisture surveys can become an added value to a routine maintenance program. When annual visual roof-top surveys are scheduled and performed to assess the condition of a roof, a moisture survey can be an additional “tool” in the assessment process. Whether the annual visual inspections are performed by a contractor, owner or independent third party, roof moisture surveys benefit all.

When moisture surveys are performed early on and throughout the life of a roof, small problematic areas that may occur within a one-year time frame can be detected rather than going undetected year after year.

Even if an annual maintenance program is not implemented, a moisture survey can be a valuable tool. If a one-time assessment of the condition of the roof is performed, it becomes more critical to document the condition of the substrate materials. Although a roof may appear to be in relatively sound visual condition, underlying “wet” materials could promote premature deterioration of the roof system components.

In conjunction with maintenance, moisture surveys can also help contractors, building owners and others make an accurate assessment of a roof that has sustained physical damage due to severe weather incidents. For example, if a roof sustains isolated physical damage (i.e., metal edge separation or lightning strike), the moisture survey can identify if moisture has entered the roof system at the specific area and migrated.



Typical moisture meter test at core.

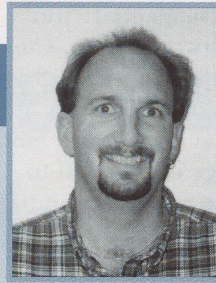
Repair/Replacement

Moisture surveys can also benefit an individual (contractor, architect, owner, etc.) when an assessment of the condition of the roof is to be performed to determine repair or replacement options. Prior to the preparation and implementation of a repair scope of work, a moisture survey can be performed. This survey can help in identifying problematic areas that otherwise may not have been addressed in the repairs. In addition, if a significant amount of wet substrate materials is identified, then it may not be cost-effective to spend the money on repairs.

If the decision has been made that a new roof is required, a moisture survey can be a benefit. If a new recover roof system (existing roof remains) is being considered, the moisture survey can identify areas containing wet substrate materials which would need to be removed and replaced prior to installation of the new roof. If it is proposed that the existing roof be removed, identification of areas retaining moisture can help in quantifying anticipated repairs/replacement of deck materials. Deck materials often become deteriorated or non-salvageable when moisture is retained against the respective material for an extended period. This identification of wet areas can also assist the individual in determining sequencing and/or appropriate materials to be utilized during the roof replacement.

If a significant amount of water is encountered within the roof assembly (which is common on structural concrete decks), proper precautions should be made during the roof removal process. Pumps, polyethylene sheeting and other emergency types of equipment, tools, and materials should be readily available when these areas are encountered during the roof removal process. Furthermore, if existing decking materials have been subjected to extended periods of moisture, the decision may be made to utilize different attachment methods (mechanical attachment versus hot mopping/adhesive) or different materials (venting base sheet versus glass base sheet or fiberglass insulation versus fiberboard) for the new roof assembly.

In summary, a non-destructive moisture survey can be a valuable asset to all parties involved in the roofing industry. Each technique has its specific limitations and applications, and when properly implemented, can provide the end user with important information to make the appropriate assessment of existing conditions. Costs associated with these surveys vary and could range from \$0.01 to \$0.25 per square foot of roof area, depending on the comprehensiveness of the scope of work and size and configuration of the subject roof. Whatever the initial cost of the survey, the resulting information could provide exponential savings or, as a minimum, a direct immediate return on the investment.



About The Author

Karl A. Schaack received a bachelor of science degree in civil engineering from Clemson University and is a professional engineer in the states of South Carolina, North Carolina, and Texas. He is Vice President of Houston Operations for Price Consulting, Inc., and is a Registered Roof Consultant through RCI.

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