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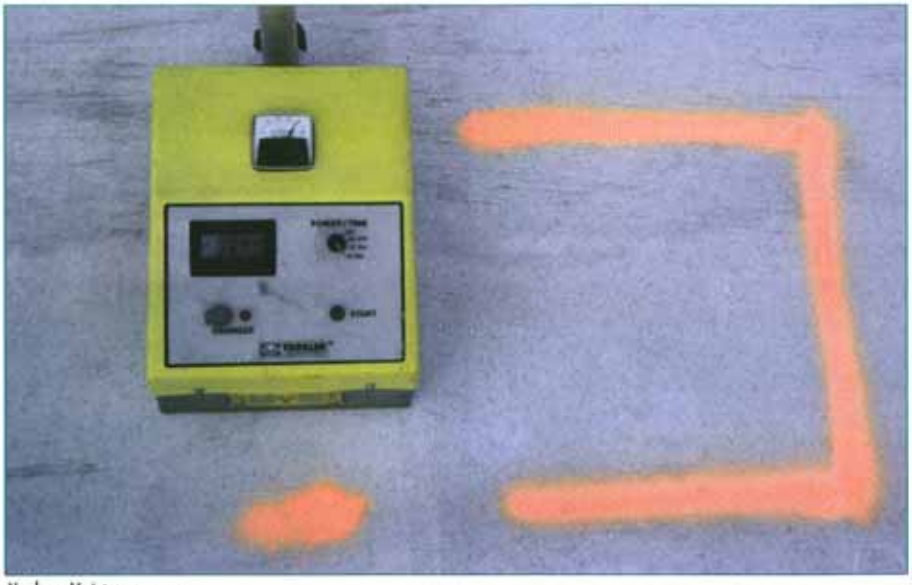
ROOF MOISTURE SURVEYS: An Effective Tool For New Construction AND MAINTENANCE PROGRAMS



Nuclear Moisture gauge

When properly executed, non-destructive moisture surveys can be effective tools for monitoring the condition of substrate materials (insulation board and absorptive decking material) in new or old roofing systems.

They are used to identify the extent of moisture infiltration within a roofing system. Non-destructive moisture surveys typically include one or more of the following techniques: **Infrared Thermography, Nuclear Moisture Meter Technology or Electric Capacitance Moisture Meter Technology.**

MOISTURE SURVEY METHODS

Infrared Thermography surveys basically identify thermal anomalies located on the roof. These anomalies are usually associated with roofing substrate materials that have retained water. During warm weather, "wet" substrate materials will retain a greater amount of heat than similar materials that are dry. At sunset, when the heat source is removed, roofing surfaces cool down. Infrared cameras can detect the "heated wet" substrate material below the surface. During cold winter months, infrared cameras can detect the heat that is transferred through the "wet" substrate materials due to the reduced thermal resistance.

Infrared thermography surveys can be conducted successfully with both hand held and mounted equipment. Aerial thermographic surveys can provide quick and cost effective assessments of numerous roofing systems or one very large roofing system. However, on small and/or roofing systems covered with excessive roof-top equipment, aerial surveys have real limitations. Furthermore, roof-top access is always necessary to verify findings and questionable conditions. With hand held equipment, every square foot of the roofing surface can be surveyed and actual boundaries or delineations between "wet" and dry areas can be accurately identified and documented. With this method, the survey team can instantly verify the thermal scan findings, and check them, if necessary. This survey technique (hand held) is only limited by the site's physical and weather conditions. Whether hand held, on site, or aerial, infrared thermographic surveys must be conducted after sundown.

Infrared Thermographer

Thermal Anomaly

Nuclear Moisture Meters record the level or amount of hydrogen atoms located within a roofing system. A small radioactive source within the meter emits neutrons when the meter is activated. The neutrons react with hydrogen atoms located in the roofing system and are backscattered. The meter records the number of neutrons that are backscattered, indicating the presence of hydrogen atoms. The presence of hydrogen atoms indicates water or moisture has penetrated the roofing surface. The higher the number of hydrogen atoms,

the greater the level of moisture present. This survey technique requires the recording of meter readings obtained from a 5' x 5' or 10' x 10' grid placed on the roofing system surface. Once the readings have been secured, a statistical analysis is performed to identify and confirm the location of "wet" and dry readings. Core boring of the substrate are taken to confirm the meter readings. The quantity and extent of the moisture impacted areas is then extrapolated between the grid points. Although this survey technique takes time, it can be conducted at any time during the day. Typically, the findings are considered "limited" since the "wet" areas identified are based on estimations and not actual findings. Therefore, when used, this survey technique should be coupled with either infrared or a capacitance meter survey to secure the most reliable results.

Electric Capacitance surveys are based on the dielectric constants of materials. Most materials used in roofing systems construction have a lower dielectric constant than water. When moisture within the substrate is encountered, the meter records the level. High meter readings indicate major moisture penetration. This survey technique also utilizes a grid layout similar to the nuclear meter survey method. A mobile or rolling model of the capacitance meter is available. It is easily transported across smooth surfaced roofing systems for surveying large roof areas. When the grid type survey is used, confirmation of roofing components and extrapolation of the findings are performed. This survey can be performed at anytime, as long as there is no moisture on the roof surface or within the membrane. If those conditions prevail, they will "mask" the actual condition of the underlying materials. For EPDM roofing systems, a special model of the capacitance meter is used.

For new construction or routine maintenance programs, these survey methods can be valuable tools for the architecture/engineer designing the system, the owner who has to maintain the facility and the contractor who installs roofing systems.

Thermal anomaly denoted on roof

NEW CONSTRUCTION

During the construction/installation of a new roofing system, moisture surveys are employed for the following reasons:

- During construction, if water penetration is suspected, a moisture survey can determine the degree of penetration and level of damage.
- Moisture surveys are used to resolve disputes regarding actual damage.
- Upon completion of new roof installation, a moisture survey documents any possible areas of water infiltration and provides a "baseline" of the condition of the substrate to establish a record of the new roofing system for warranty and maintenance purposes.

ROOFING SYSTEM MAINTENANCE

Following the repair or installation of a new roofing system, moisture surveys are an added value to the routine maintenance program. As part of the annual roof-top physical survey, scheduled to identify and determine the overall condition of the roofing system, a moisture survey should be part of the process. When conducted on a routine basis as part of the maintenance program, moisture surveys have a significant impact on extending the life of the roofing system. Using moisture surveys, early detection of problems can result in major cost savings for routine as well as extensive repairs and components replacement. When problems go along

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Moisture probe testing of substrate

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undetected year after year, the life cycle of the roofing system is reduced and the costs for repairs or replacement are increased.

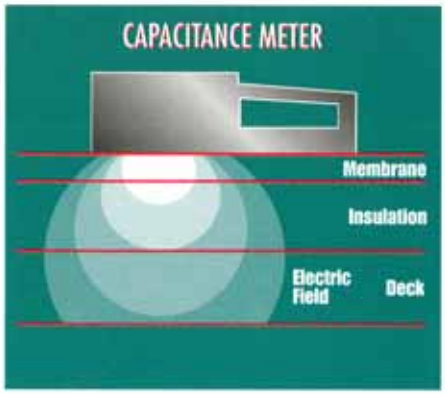
Even if the owner or manager of a facility does not have a structured routine maintenance program, a moisture survey can be a valuable tool. Even a one time assessment of the roofing system is better than none at all. It can identify and help document the condition of the substrate materials. Although a roofing system may appear to be in good shape from visual observation, significant moisture penetration may have occurred below the surface, promoting premature deterioration of the roofing system components.

As part of a routine maintenance program, moisture surveys can also help contractors and building owners make more accurate assessments to determine the true level of roofing system damage caused by severe weather conditions. For example: If a roof sustains isolated physical damage such as, the metal edge pulling away following a storm or lightning strike, a moisture survey will determine the degree of water penetration the roofing system may have sustained, in specific areas, and where the moisture may have migrated. Again, the potential for cost savings and extending the life of the roofing system, are self evident.

REPAIR OR REPLACEMENT

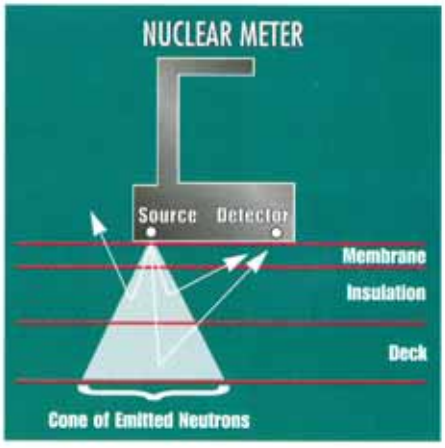
Moisture surveys are extremely valuable tools for the architect/engineer, owner, facility manager and contractor faced with the challenge of determining whether to repair or replace a roofing system. When an assessment of the roofing system is to be performed, to determine which option to exercise, a properly executed moisture survey can help all parties involved select the best course of action.

Prior to the preparation and implementation of the scope work - for repair or replacement - a moisture survey should be performed. The survey will



help identify problems that otherwise may not have been addressed. If a significant amount of wet substrate material is identified, along with other deterioration factors, it may not be cost effective to repair the damage. Total replacement may be the most cost effective solution for the short and long terms. In either case, the moisture survey can be an important factor in the decision making process.

If the decision focuses on securing a new roofing system, a moisture survey can be of significant value at that time also. For example: If a new recovery roofing system is being considered (the existing roof remains), the moisture survey can identify areas containing wet substrate materials that need to be removed and replaced prior to installation of the new roof. If the existing roof is to be removed, identification of moisture penetrated areas can help quantify anticipated repairs or replacement of decking materials. When moisture penetrates the roofing system, deck materials often become deteriorated and non-salvageable. If a significant amount of



water is encountered within the roofing assembly - a common problem with concrete decks - proper precautions must be taken during the roof removal process.

Polyethylene sheeting, other roofing components, pumps, necessary equipment, tools and emergency equipment should be readily available during the roof removal process. Furthermore, if existing decking materials have been subjected to extended periods of moisture, all parties concerned may need to consider using different attachment methods (mechanical versus hot mopping/adhesive) and different materials (venting base sheet versus glass base sheet and/or fiberglass insulation versus fiberboard) for the new roofing system assembly.

SUMMARY

A non-destructive moisture survey can be a valuable asset in the management and maintenance of new and existing roofing systems. As described herein, it is obvious that each technique has specific applications and limitations. When properly implemented by qualified and trained roofing consultants or maintenance personnel, each survey technique can provide the user with important information for making appropriate assessments of existing roofing system conditions.

Cost associated with these surveys vary, ranging from $0.01 to $0.25 per square foot of roof area surveyed - depending on the comprehensiveness of the scope of work, size and configuration of the roof being surveyed. Whatever the initial cost of the survey, the information gained consistently results in providing the facility owner/manager with exponential savings and a direct immediate return on this investment. RM

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