THE VOICE OF PROFESSIONAL ROOFING CONTRACTORS

ROOFING BC

VOLUME 13 | NUMBER 1 SUMMER 2016

VEGETATED ROOFS: *Are They Worth The Cost & Effort?*

CSA 123.24 New Wind Resistance Standard for Vegetated Roofs

ROOF MAINTENANCE: *New Leak Detection Systems Provide Early Warning of Potential Problems*

RCABC ROOFING CONTRACTORS ASSOCIATION OF BRITISH COLUMBIA

PM #40787580

ASSET PROTECTION:

Systematic Roof Moisture & Leak Monitoring

By JASON TEETAERT, P. Eng, Vice President of Business Development, SMT Research Ltd.

Construction liability for damage related to moisture and mould is on the rise. Insurers are responding by eliminating water damage coverage from their policies.

Consequently, building owners and stakeholders need tools to minimize and mitigate the risk of costly damage. Timely and accurate information regarding performance of the building envelope, particularly those areas most susceptible to moisture damage, allow appropriate remedial action to be taken before permanent damage has occurred. Not only is this data useful throughout construction, commissioning and life of the structure, it also provides feedback to engineers and researchers on which designs, materials and methods are most robust and reliable.

Ultimately, timely notification of issues leads to better quality assurance during construction, more focused and timely maintenance while in service, and a more durable, cost-effective and environmentally-friendly structure.

Monitoring systems provide a cost-effective means of delivering detailed information about a structure to your fingertips and provide information that will help extend building life.

Specific Building Intelligence systems have been developed for roof and waterproofing leak detection in commercial low-slope roofing systems. Commercial low-slope systems fall into three, broad categories:

(1) Point-in-Time Leak Locate Tools.
(2) Active Real-time Monitoring Systems.
(3) Investigative Systems.

Point-in-Time Measurement Systems

These systems include traditional methods and tools for quality assurance and leak investigation in roofing and waterproofing membranes. The methods include visual inspection, cut test, pull/adhesion testing, thickness and flood testing. They often occur on a random sampling of the target or during a specific construction phase. The results of this type of testing are generally only valid for a very specific sample, at the time that the testing was carried out.

Point-in-time tools that offer more extensive target coverage include infrared and hand-held, non-invasive moisture scanning. For conventional roof systems these methodologies provide a broader picture of the current status of moisture penetration and moisture mapping, and may indicate the location of a leak.

Locating leaks on inverted roof membranes during or after construction allows quality inspection on the newly-applied membrane. For inverted or protected membrane roof (PMR) systems, low voltage electrical scanning or high voltage dry testing offers more extensive quality assurance during the construction phase. With PMR waterproofing, a comprehensive roof scan during construction may be added to the completed area or used as a stand-alone

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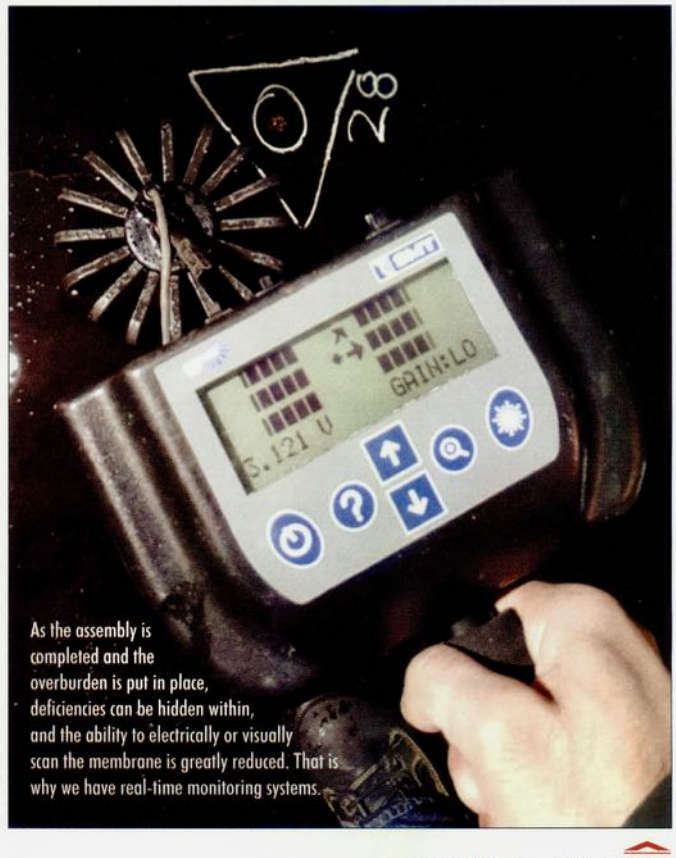

As the assembly is completed and the overburden is put in place, deficiencies can be hidden within, and the ability to electrically or visually scan the membrane is greatly reduced. That is why we have real-time monitoring systems.

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leak investigation service. Electric field digital multi-vector mapping technology helps illuminate the overall integrity of the membrane surface using manual measurements.

The construction stage is where the greatest value can be achieved from "Point-in-Time" measurements and visual inspections. As the assembly is completed and the overburden is put in place, deficiencies can be hidden within, and the ability to electrically or visually scan the membrane is greatly reduced. This is why we have real-time monitoring systems.

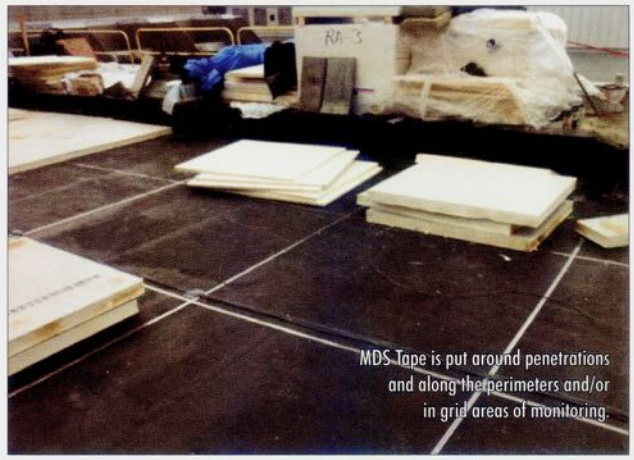
Active Real-Time Monitoring Systems

Active monitoring and reporting solutions are available to protect any critical asset or structure. Through early notification, changes in roof conditions can be monitored to identify areas where maintenance is required to ensure building integrity, thereby saving millions of dollars per year in loss claims. Additionally, a monitoring system placed during membrane installation will ensure quality assurance throughout construction all the way through to occupancy, and will assist with long-term building maintenance.

Conventional / Low-Slope Roof Assemblies

Sources of water and moisture damage in conventional low-slope roof systems come from three sources: membrane leaks, construction moisture trapped within the system and condensing air barrier leaks. Each type of moisture intrusion can cause premature aging of the roof assembly by undermining construction adhesives or corroding mechanical fasteners. Latent moisture within the assembly reduces assembly R-value, leading to increased building energy use.

A way to gain knowledge of the prolonged effect of entrapped moisture is to apply stainless steel moisture detection sensor (MDS) tapes under waterproof membranes. These sensor tapes are connected to data acquisition nodes that will communicate to cloud servers for remote data review. The information will provide property maintenance teams with the ability to detect and locate physical moisture, and ultimately control its impact.



MDS Tape is put around penetrations and along the perimeters and/or in grid areas of monitoring.

When MDS tapes are monitored from the installation date, the building Analytics software can analyse the difference between, and significance of, a membrane leak, construction moisture and condensation arising from air barrier leaks.

MDS tape is put around penetrations and along the perimeters, and / or in grid areas of monitoring. The choice of sensor locations and type of data acquisition system can be customized to suit the lay-up and lay-out of the roof.

SMT prefers to place the sensors on the vapour retarder / air barrier level at the lower point of the roof. This takes advantage of two factors: **(1)** Gravity pulls water down through the cracks and spaces in the insulation to the lowest point; and **(2)** Installation is easier to coordinate at this point in construction. The system works with all membrane types, including two-ply SBS, single ply membranes and even loose laid EPDM roofing systems.

Inverted / Protected Membrane Roof Assemblies (PMR)

As with conventional roofs, live monitoring allows continual assessment as to the when and where a potential membrane failure may have emerged in an inverted or PMR roofing system – even after the overburden is in place.

The Moisture Detection Sensor Grid is placed on the top side of the membrane and uses the same theory of operation as does the low-voltage electrical digital multi-vector scanning solution. The monitoring system looks for changes in the electrical properties between the installed grid when a membrane hole makes an electrical connection from the top side of the membrane to the concrete or metal deck below.

The installation of the stainless steel

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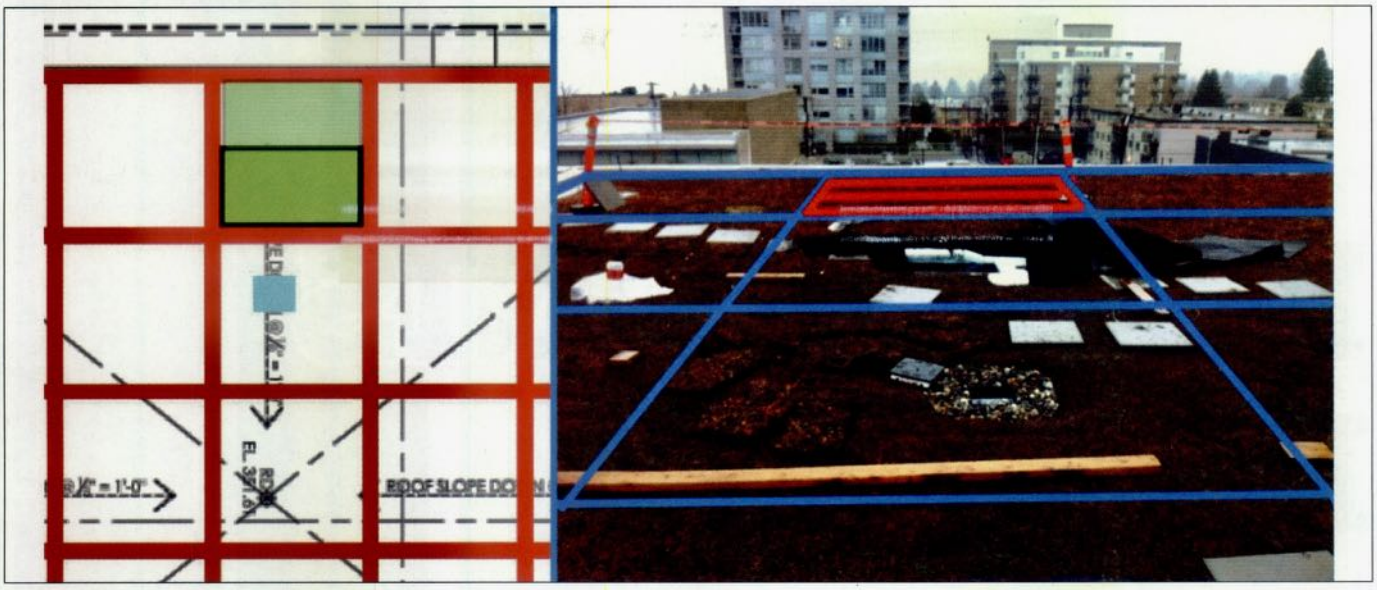
detection grid is completed on the top or wet side of the waterproofing membrane. The image in *Figure One* (left side of image) shows a screen shot of a Building Intelligence automated monitoring system. Blue indicates where the leak was visible from below the surface. Green indicates the area where the leak may be located from the automated system. The photograph (right side of image) shows a grid overlay over the area of interest on the actual roof.

Building owners and operators are interested in the mitigation of risk from facility floods, aged roof systems and costs associated with potential water damage.

Automated Monitoring for Existing Roofs

During construction or when re-roofing is occurring is the most cost-effective time to install a permanent leak detection system, although roofs protecting critical assets just cannot wait for proactive monitoring systems. The automated monitoring of roof conditions from the underside of the roofing deck can be applied to most roofing systems by monitoring for moisture content in the insulation or the deck below the roofing membrane.

FIGURE ONE. This image shows a screen shot (left) of a Building Intelligence automated monitoring system and a photograph (right) with a grid overlay over the area of interest on the actual roof.



The installation of Point Moisture Monitoring Sensors (PMM) from below can be used to provide an automated moisture map for existing roofing systems when installed in a grid lay-out. The system can also be applied to specific areas for problematic roofing systems, early notification or leak detection analysis. In addition to point moisture content, other sensors can report on condensation, dew point, temperature profiling, vapour pressure, differential air pressure, installed R-value and building component movement in the investigation of roof performance.

Real-time assessments save real-time dollars. The adoption of fully-automated membrane monitoring systems is used as a quality assurance solution during construction. A permanently installed system will report on the integrity of the waterproofing assembly over the entire functional life of the roof.

About The Author

Jason Teetaert, P. Eng., is Vice President of Business Development at Structure Monitoring Technology (SMT) Research Ltd. He has over 25 years of project management and electrical engineering construction design experience, with current projects in the application of structure monitoring systems. Teetaert holds patents in the areas of moisture detection, and patents pending in roof monitoring and low powered hybrid wireless / wired networks. SMT Research Ltd. provides software and electronics that are used to monitor and evaluate the integrity of enclosures of commercial and residential building. Real-time sensor analysis and remote data collection have allowed engineers and researchers to validate designs, materials and methods to produce more efficient and durable buildings. For more information, visit www.smtresearch.ca.

Editor's Note: The RCABC RoofStar waterproofing guarantee program requires a modified passive grid system where a point-in-time scan is completed prior to covering with overburden. Future leak investigation will use a passive grid system which is installed on the wet / top side of the membrane, and can be utilized to locate a leak, as well as provide pro-active leak maintenance. The passive grid system has no automated electronics left on-site. The leak detection technician brings the system electronics to the site when required for use.

The RCABC Roofing Practices Manual states the use of a six-foot grid system under a permanent overburden such as concrete, and a 10-foot grid system where the overburden is reasonably accessible *(remove plant and green roof overburden is under eight inches)*. No grid system is required for pavers on pedestals.

For more information, call an RCABC Technical Advisor – (604) 882-3425.