A New Leak Detection Technique

Charlie Miller, P.E., Roofscapes, Inc.
Chris Eichhorn, International Leak Detection, Ltd.

Electric Field Vector Mapping® (EFVM®), a new and powerful tool for improving quality control of waterproofing systems, is now available. Although this method is unfamiliar to most Americans, it has already achieved a long record of success in Europe.

Unlike most other leak detection methods, it can quickly and accurately locate the point of water entry. Another unique aspect of this technique is that a pinhole (too small to find visually) is as easy to locate as a large tear or failed seam. Alternative approaches, such as infrared surveys, can determine where water has accumulated in the insulation, but may not be as useful in actually finding the waterproofing defect.

The EFVM® technique uses water as the electrically conductive medium. The survey technician installs a wire loop around the perimeter of the area to be tested and introduces an electrical potential. The area within the loop is dampened to form an upper electrical ‘plate’. The structural deck is the lower electrical plate, while the membrane separating the two plates acts as the insulator. If moisture enters a defect in the membrane, an electrical contact is established between the two plates (i.e., an electrical ground). The survey technician can then follow the direction of the electric field to the membrane defect.

The technique was pioneered in Germany by AB Flachdach Mess und Trocknungstechnik GmbH (AB Flachdach) in Germany. It is now available through their North American partner, International Leak Detection, Ltd. in Ontario, and through Roofscapes, Inc., a nation-wide green roof provider based in Philadelphia.

The benefits of EFVM® can be summarized as follows:
- Locates defects precisely, enabling efficient repairs
- Able to re-test repairs immediately
- Can be used AFTER cover systems are installed, especially with ‘green roof’ landscapes
- Less expensive than conventional flood testing
- Eliminates the hazard of overloading structural decks during testing, since ponding water is NOT part of the testing procedure
- Can be used on steeply sloping roof surfaces where flood testing is impossible

EFVM® has been used successfully with a wide range of waterproofing materials in Germany. AB Flachdach has electronically surveyed 35 million square feet of roof membrane in the past five years. However, an even broader range of waterproofing materials is in use in North America. The suitability of EFVM® depends on the electrical resistance of the water-proofing materials. In particular, EPDM membranes vary in their electrical properties, and some formulations containing carbon black may not be compatible. Aluminized protective coatings, commonly used in the US in conjunction with modified bituminous membranes, may also defeat the technique.

Special procedures are required when using EFVM® on projects with supplementary root barriers. The root-barrier membrane will act like an insulating layer. Therefore, it is necessary to make small incisions in the root-barrier to establish electrical contact with the underlying waterproofing membrane. These incisions can be re-sealed after the leak is located.
International Leak Detection Ltd. can conduct bench-scale tests in order to establish that EFVM® is suitable for a particular waterproofing material. EFVM® can also be used on all types of roof decks, including steel, concrete, and wood. (A special ‘grounding grid’ must be introduced in this case.)

The EFVM® method has proven highly advantageous in situations where the water-proofing is concealed or buried. These include IRMA (Inverted Roof Membrane Assembly) configurations, plaza installations, ballasted roofs, and ‘green roofs.’ Green roofs are veneer landscapes installed on top of conventional roofs. They may be anywhere from 2.5 inches to 3 feet deep. Without an effective method of locating defects, leak location and repair could become very expensive on these systems. For this reason, Roofscapes, Inc. offers the EFVM® technique as a standard option in its green roof installations. Currently, EFVM® is being used on numerous Roofscapes projects, including Point Defiance Zoo in Washington State, and a large chiropractic center in Pennsylvania.

A recent project in Frankfurt, Germany, illustrates the value of EFVM® as a loss prevention technique. This project involved an 110,000-square foot roof that was installed in 2000. The technicians found 17 defects in the membrane. Some of these flaws were located in defective seams (workmanship) but others were tiny punctures. There was no visible water damage in the interior of the building. The building owners did not know that there were any problems and probably would not have found the flaws until the insulation had become saturated.

For more information please contact:
- Charlie Miller at Roofscapes, Inc. (info@roofmeadow.com), or
- Chris Eichhorn at International Leak Detection Ltd. (chris@leak-detection.com).