



Structure Monitoring Technology

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**FutureCast** ™  
ACTIVE

The logo icon for FutureCast consists of a central Wi-Fi symbol surrounded by a circular arrangement of plus signs.

From Deck to Cloud:  
Leak Detection Systems for  
Conventional Roof Assemblies

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## INTRODUCTION

We are delighted that you are considering SMT for your project. For over 15 years we have been trusted by architects, general contractors, roofers, and building owners to install state-of-the-art sensors and enable the best possible leak detection.

FutureCast Active is a Leak Detection System (LDS) for conventional roof assemblies. It enables non-destructive monitoring of the roof assembly, saving time and reducing the scope of costly tear-up during a leak inspection, ultimately limiting inconvenience to tenants and disruption to business.

Used properly, a FutureCast Active can:

- Monitor moisture within the layers of the roof assembly
- Alert owners to moisture build-up which can indicate a leak
- Guide maintenance managers in a leak investigation
- Verify the success of leak repair
- Inform decisions on deferred maintenance
- Extend the useful life of the roof
- Give tenants peace of mind

This document gives an overview of how FutureCast Active works, the steps required to install and operate the system, and the benefits to the structure and its owners.



*Above: FutureCast's sensor grid sits on the lowest layer of a conventional roof assembly*

## DESIGN + INSTALL CHECKLIST

The following check-list outlines the process for design and installation of a FutureCast Active Leak Detection System on a Conventional Roof Assembly.

01. Design Team / Roofing Contractor submits shop drawings of roof deck to SMT.
02. SMT provides a Budget Estimate for the Project.
03. Project goes ahead. SMT provides a Purchase Order for Materials, Labour, and Logistics.
04. Roofing Contractor prepares roof deck for installation, coordinates with project site supervisor and SMT operations manager to schedule install.
05. SMT installs FutureCast sensor grid on the lowest vapor barrier.
06. SMT connects direct burial cable from the sensor grid.
07. The Roofing Contractor covers the FutureCast grid (same day as install).
08. SMT installs a Junction Box on the roof deck, some projects require multiple boxes.
09. SMT routes cables from the FutureCast sensor grid to the Junction Box.
10. Electrical Contactor routes power and data connections to Junction Box
11. SMT installs Monitoring Electronics in Junction Boxes
12. Building Owners and SMT agree Monitoring Contract
13. SMT provide additional services as agreed in contract, including:
  - Submit FutureCast Active Basic Report
  - Submit FutureCast Active Advanced Report
  - Perform System Maintenance / Updates
  - Provide system training for Maintenance Team
  - Provide additional Leak Detection Services

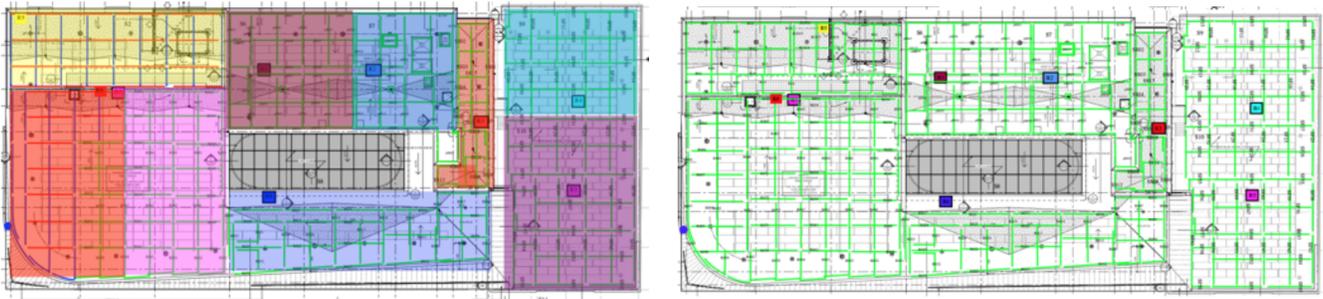
Read on for a more comprehensive overview of the FutureCast Active system, or contact SMT to discuss how we can assist on your project.

## BUDGETING AND PLANNING

### *Defining the Scope of your System*

Our team will advise and educate on Leak Detection in general, and help find the right scope and configuration of Leak Detection System for your project. For designers, SMT offers ready-made specifications for FutureCast Active systems; these can be found on our website and inserted directly into the project specification.

A budget estimate can be produced if SMT is provided with clear drawings. SMT technical consultants will create CAD drawings to show where the system will be installed, splitting the roof deck into zones based on square footage and topography.



*Roof Deck divided into zones for FutureCast Active Install (Left)  
FutureCast sensor grid gives wide coverage of roof deck (Right)*

### *Who to Call:*

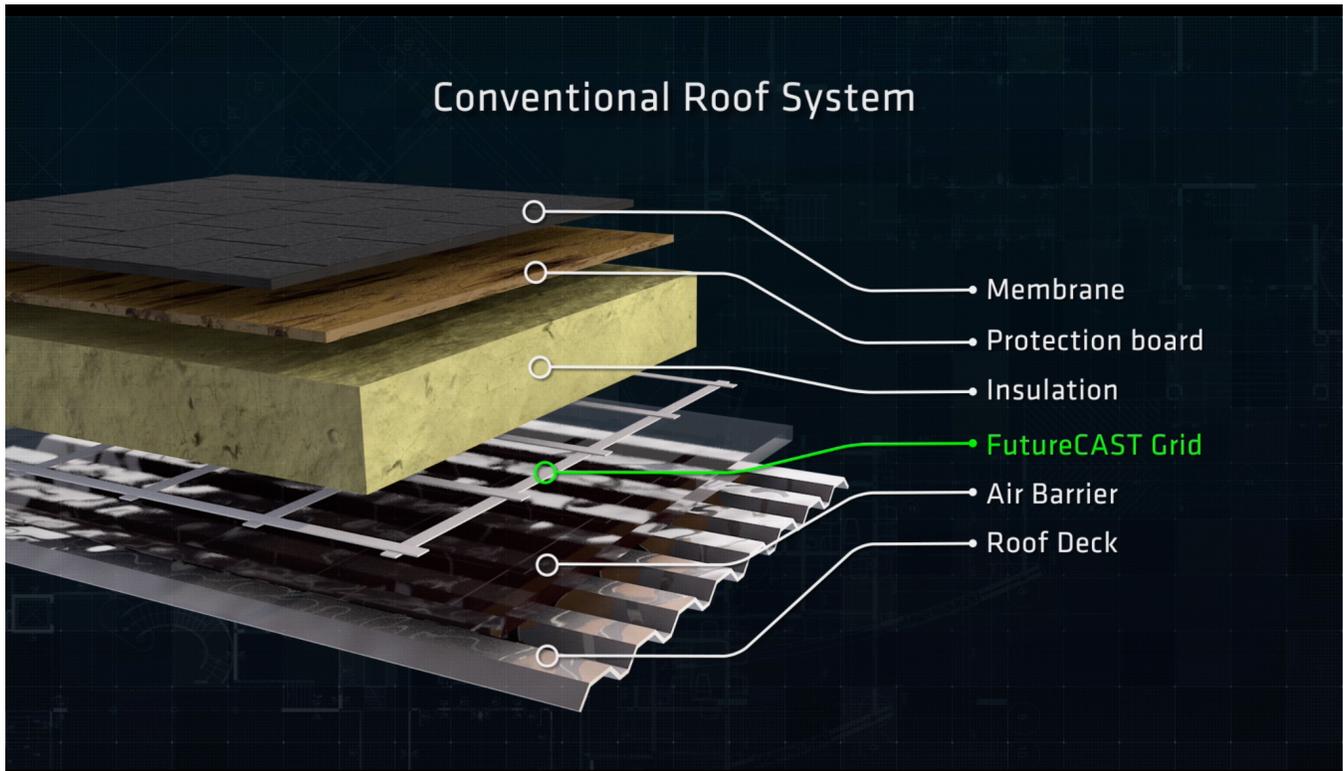
**Technical Consultant:** for assistance with design, budget estimates, and quotes. Can provide updated quotes as project specifics change over time.

**Operations Manager:** for availability of technicians and scheduling installation of FutureCast Active Leak Detection System. Also your point of contact for billing and reporting.

**Project Manager:** SMT's project manager will keep everyone informed on a daily basis of project progress and any needs that may arise.

## HOW IT WORKS

FutureCast Active uses resistance-based measurements to determine the presence of moisture below the waterproof membrane on a conventional roof assembly. The FutureCast Grid is made up of moisture sensors laid out in strips which are sensitive to the presence of moisture and are therefore triggered when water is allowed to accumulate inside the roof assembly.



*Above: The FutureCast Grid is installed on the lowest possible layer of a conventional roof assembly in order to track moisture that has worked its way down through the protection layers or detect condensation from construction and operation activity which has been sealed inside the assembly.*

## INSTALLATION

### *Preparing the Deck:*

SMT works within the typical construction schedule, communicating with roofers and site supervisors as is necessary to install the system efficiently. The deck must be clean and dry. Metal debris and any sources of moisture - no matter how small - should be actively looked for and removed.

### *Applying Sensors:*

SMT applies strips of Moisture Detection Sensor (MDS) tape, typically placed directly on the lowest vapour retarder. The MDS tape is low-profile mylar with twin strips of stainless steel conductor on one side, and adhesive backing on the other. This tape is applied in a grid-like fashion, the size of the grid squares is determined in the initial phase of planning - 6ft x 6ft, and 10ft x 10ft are commonly used.

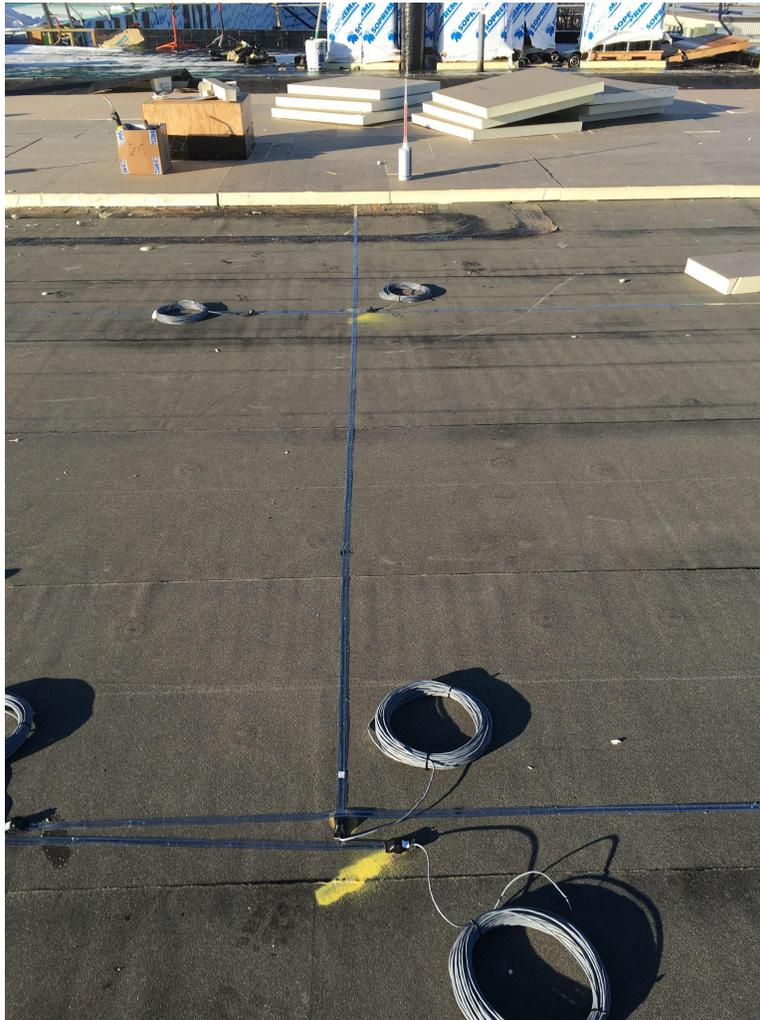
Any metallic or conductive features that will be permanently present on the deck (such as drains) are isolated from the grid by application of additional MDS, the perimeter of each zone is also isolated with MDS so that it does not interfere with future readings.



*Above: FutureCast sensor grid comprises MDS tape laid out in a grid*

### *Wiring and Covering the Sensors:*

Technicians connect a terminal block to each MDS strip, followed by a length of direct burial cable. The cable from each MDS strip is bundled and routed in as efficient and unobtrusive manner as possible. The zone is then handed off to roofing contractors so that the system can be quickly covered by cover board, insulation, and the waterproof membrane. The MDS grid should be kept dry and covered on a daily basis.



*Above: Once the FutureCast sensor grid has been applied, and cables connected, Roofing Contractors cover the system on the same day. The tape lines must be kept clean, dry, and intact.*

### *Junction Box Placement:*

The sensor cable is then routed to a watertight junction box located in a convenient location at the roof deck level. The location of the junction box is decided during the planning phase, but there is flexibility if site conditions require alternative placement.

On a typical installation, each defined zone of the roof will have its own junction box (or as many boxes are required for the number of sensors). Different sized junction boxes are used depending on the scope of the zone. The junction box is best placed at the edge of the system, mounted to a prevailing wall detail or in grade with a free standing flashing stack.



*Junction Boxes mounted to wall (left), free standing (middle), and interior (right)*

### *Data Acquisition:*

The MDS grid consists of passive sensors. In order to actively monitor the roof assembly, FutureCast requires each deck level junction box to have electronics, power, and connection to a Building Gateway. These steps require collaboration between SMT and electrical trades, and must be carefully considered during the planning phase. Read below for a detailed explanation of each requirement.

**Electronics and Power:** SMT will install a custom data acquisition board (DAQ) in each deck-level junction box, this can be done after the waterproof membrane has been installed. Each junction box requires a 12V DC connection to power the DAQ and MDS Grid. The DAQ is programmed to take

resistance-based measurements from the MDS Grid at custom intervals, and continually check for system function.

**Building Gateway:** In order to upload data to the cloud for analysis, FutureCast Active requires a Building Gateway. In most typical installations, each junction box will have its own Tactical Intelligence Gateway (TiG). The TiG is a compact Linux based computer system which requires a static IP and either solar, battery, or hardline power. These gateways allow front end control of the system, as well as data monitoring and back end control from remote locations.



*SMT can mount junction boxes onto nearly any surface, and offer various options for clients that want a more discreet aesthetic. Inside the junction box, electronic components are arranged to minimize the required space.*

*Above Right: A centralized gateway with windows laptop running BiG software, allowing greater front-end control*

### ***Additional Data Acquisition Considerations:***

**Centralized Building Gateway:** In rare cases, a FutureCast Active system may be designed with a Central Gateway rather than each deck level junction box having its own gateway. The Central Building Gateway is housed in a junction box in a secure location, decided upon during the planning phase.

**BiG:** As an alternative to the TiG, BiG is a windows-based software system which enables the broadcast of data packages from the sensor network to the cloud for analysis, visualization, and alarm setting. BiG allows the FutureCast Active system to interface directly with Building Management Systems, and is most commonly used by researchers, or clients who prefer a greater deal of interaction with the system.

**Wireless Data Transmission:** Some clients do not wish to route data cables to deck level junction boxes or central gateways. In this scenario, a cell modem can be installed in each deck level junction

box in order to transfer data to the cloud. The running costs of wireless systems are handled by the building owner.

## BMS INTEGRATIONS

Some clients wish to have the FutureCast Active LDS integrated into their Building Management System (BMS). SMT utilizes the BACnet building automation and control networking protocol, a fully autonomous, always online, executive control interface. Developed by ASHRAE, BACnet is accessible both remotely and locally, and has become the protocol of choice for most building automation control networks.

The Building Gateway communicates to 3rd party BACnet systems using BACnet IP over a standard ethernet network.

For clients that want a more customized solution, SMT offers an API for interfacing to other online Building Management Systems and Building Information Model (BIM) related graphical tools. FutureCast sensor status can be visualized on BIM models to enhance the visibility of the leak location and the conditions that lead to the leak.

## ANALYTICS, ALARMS, & REPORTS

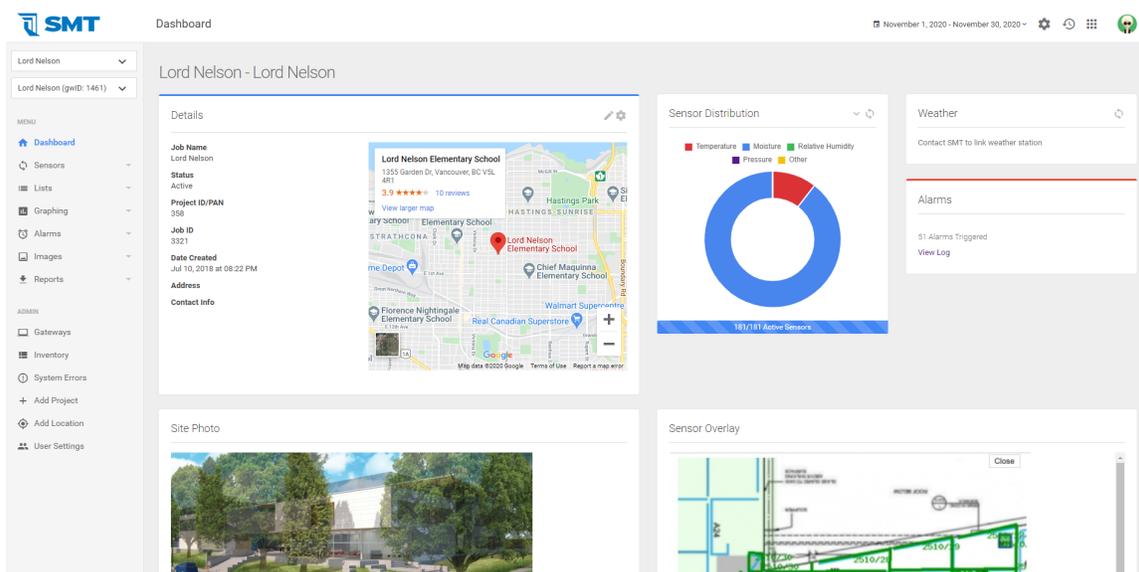
FutureCast Active can monitor the roof assembly for moisture from the moment it is installed, and SMT recommends that the system is activated as soon as possible so that it can be used as construction is ongoing.

The MDS grid takes resistance based measurements to determine the presence of moisture within the roof assembly. Once this data has been collected, it is uploaded via the Building Gateway to SMT Analytics - our proprietary platform for data analysis and visualization.

### *Analytics Centre*

FutureCast Active grants 24/7 access to the Analytics Centre platform where building owners and maintenance managers can view live data. This includes the raw data readout for each sensor, as well as sensor status. Various backend functions can also be performed from the Analytics Centre, and SMT offers training and support for clients who seek this level of control and customization.

The basic function of FutureCast Active is to show where the roof is wet, and where it is dry. The simplest way to view this information is as a 2D overlay of the MDS Grid over drawings or photographs of the roof, with red lines indicating wet areas and green lines indicating dry.



Above: Analytics is an easy to use platform for viewing your FutureCast Active sensor data and generating reports.

## Alarms

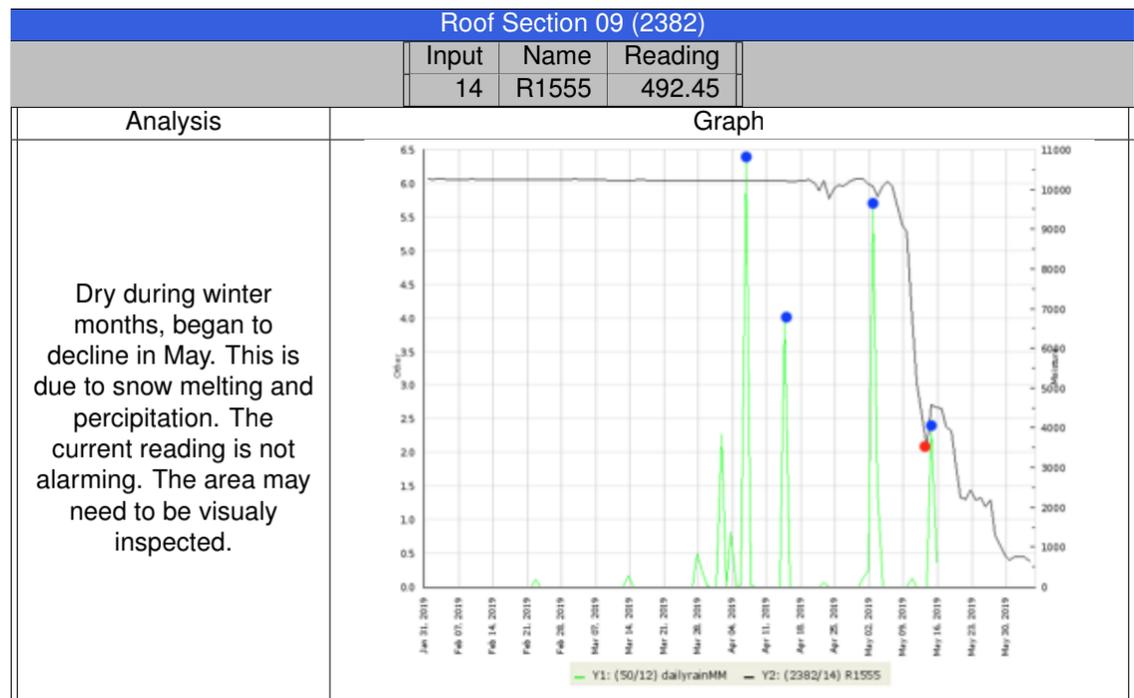
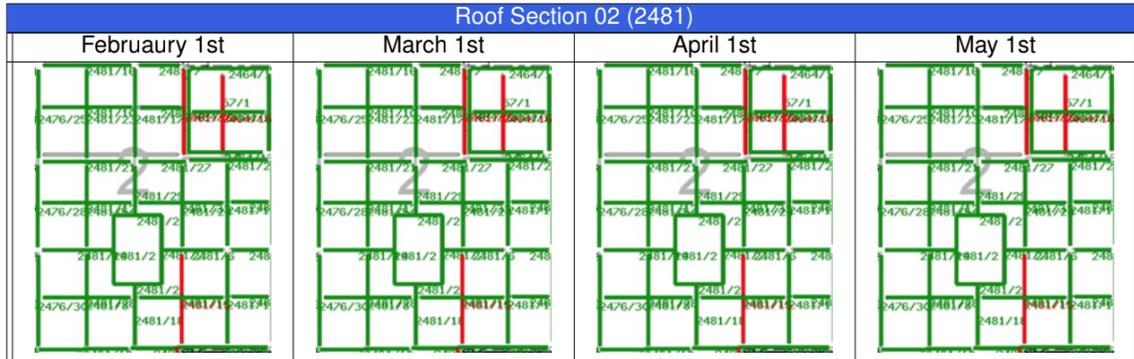
SMT can assist with setting alarm thresholds for each roof zone. When the FutureCast Active system is triggered by the presence of moisture above a certain threshold, alarms can be sent via SMS or email, or directly into a Building Management System (see integrations later in this document).

## Reports

SMT can issue a Basic Report, a snapshot of the current moisture content within the roof. This can be used on a routine basis for maintenance planning, or else as required for investigative purposes.

An Advanced Report will take into account historical data of the roof moisture content in different conditions over time, showing a moisture trend that can be used to more accurately locate areas of concern where moisture may be ingressing into the structure.

See below for sample reports:



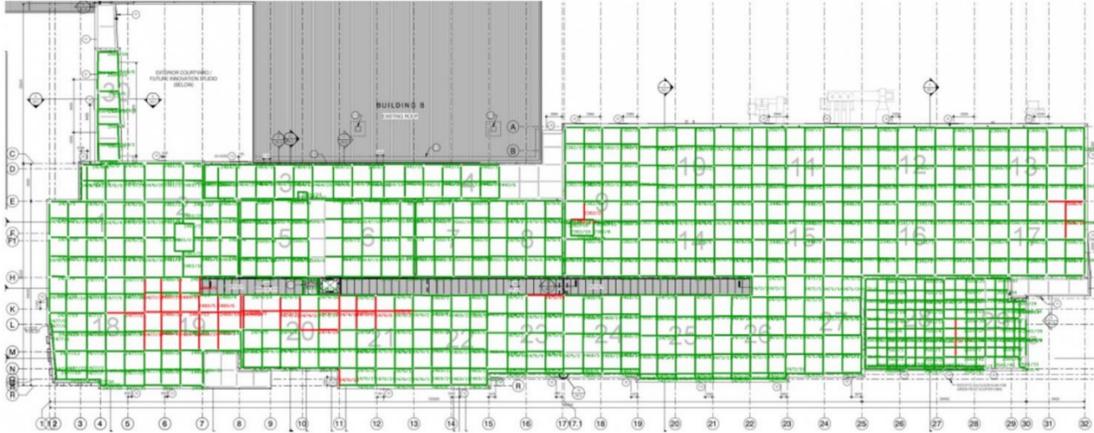


Figure 1. Event Status - May 10th, 2018

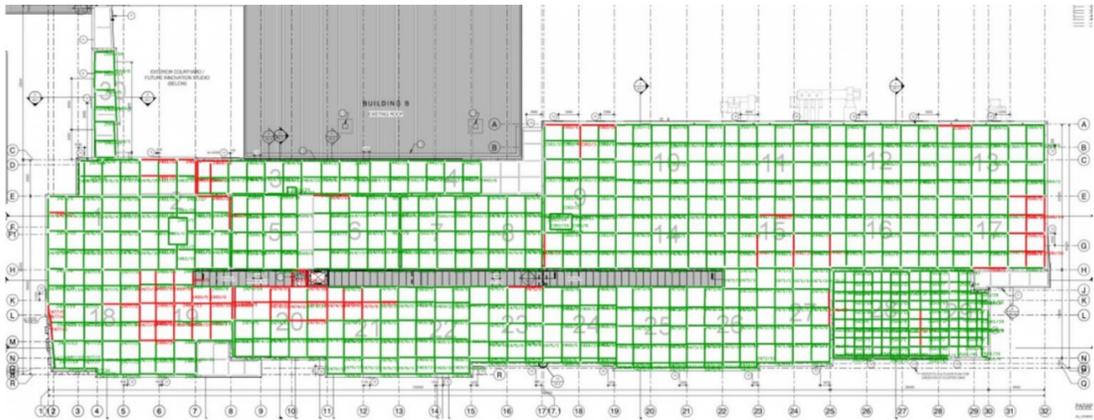
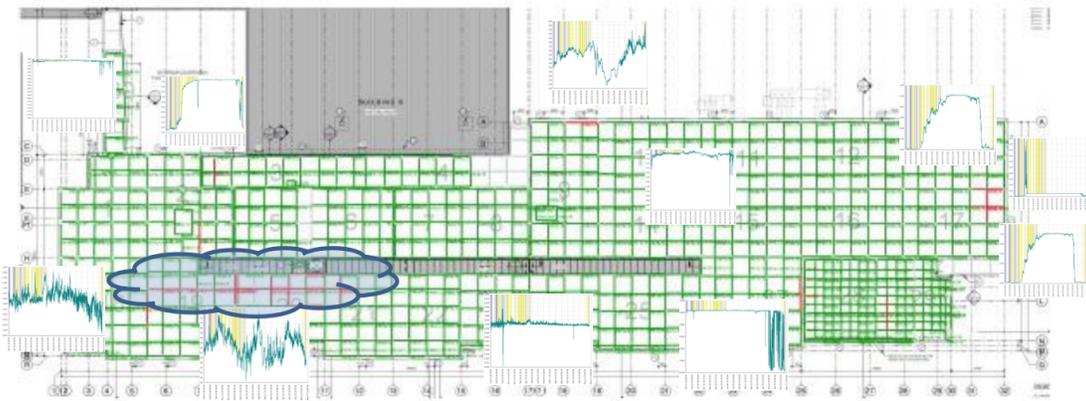


Figure 2. Event Status Sept 9th, 2018

**Location 1**

This area was identified in R01 which is likely the result of the hatch relocation. Stagnant moisture is present in the assembly. Recommend venting the roof using solar powered active vents. Moisture has been drying up since then and the size of the area affected has been greatly reduced.



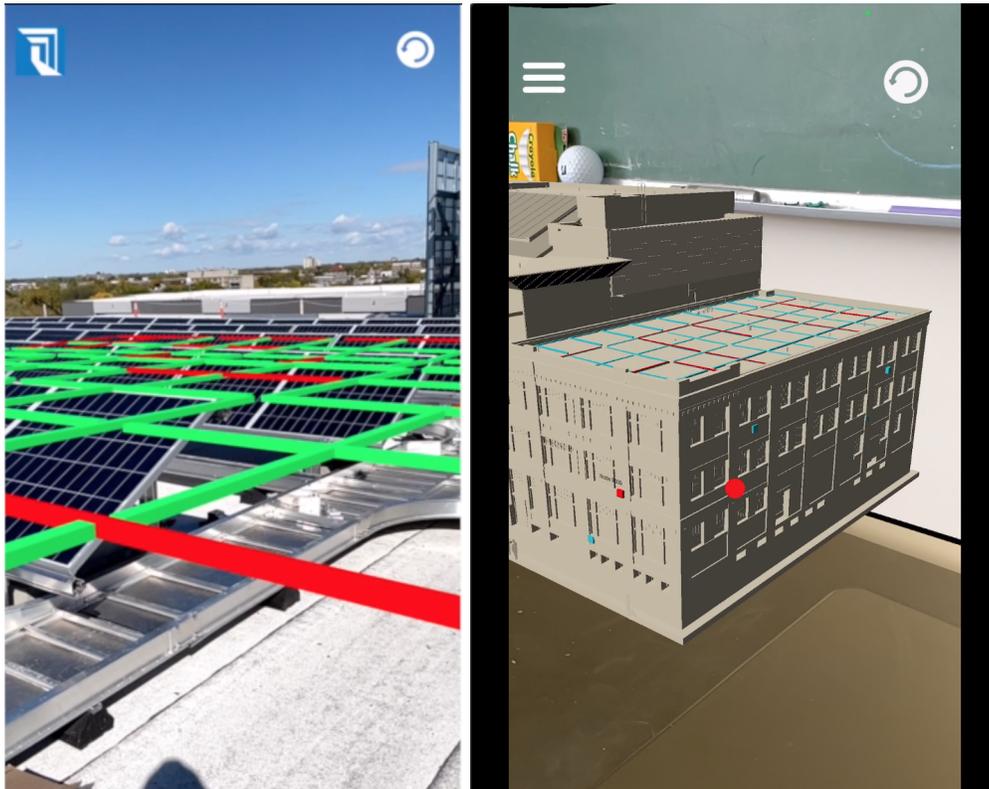
## ADVANCED DATA VISUALIZATION

FutureCast Active leverages Internet of Things connectivity to offer unique data visualization options for roof moisture content.

### *Augmented Reality (AR):*

FutureCast Active's readings can be viewed in real time in AR using a standard smartphone. An overlay of sensor status is shown through the phone camera, so that maintenance professionals can walk the roof and "see through" the waterproof membrane to the sensors below - this enables targeted repairs and allows easy monitoring of efforts to dry the assembly out.

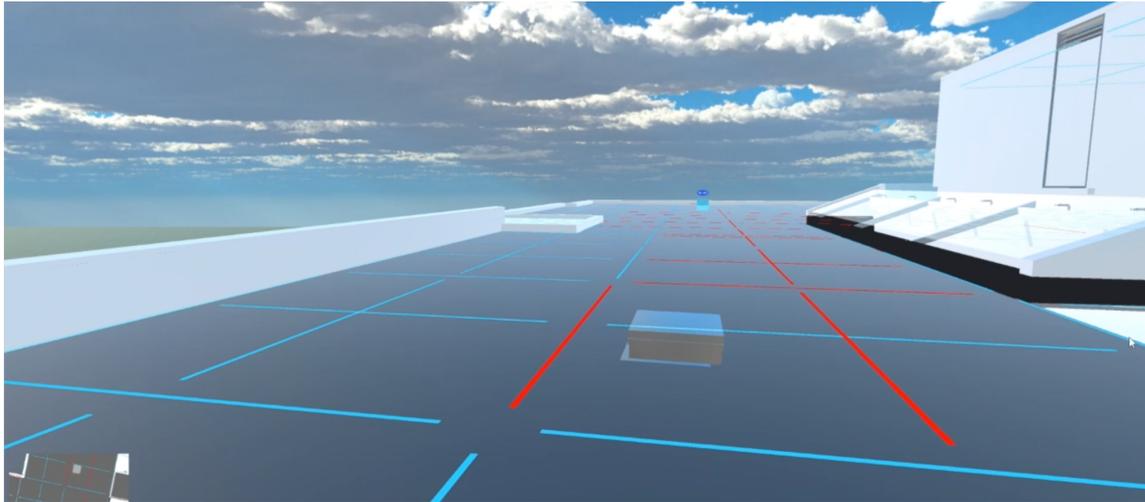
The sensor readout can also be applied to a BIM model of the structure, allowing AR to be used remotely by viewing a miniature model of your roof with live moisture status represented by the FutureCast Active MDS grid.



*FutureCast Active sensors viewed in real time on site (Left) and via BIM Model (Right)*

### *Virtual Reality (VR):*

SMT has embraced the VR revolution, and allows users to view roof moisture content through a VR lens. This option requires BIM integration.



*Above: FutureCast Active sensors viewed in Virtual Reality*

## NEXT STEPS

This document has given an overview of how FutureCast Active and Passive Leak Detection Systems are configured, installed, and operated to monitor the moisture within conventional roof assemblies.

At SMT we pride ourselves on being professional, flexible, and reliable. Please contact us if you would like any additional information, we are always happy to help.

RFQs and technical enquiries can be directed to: [info@smtresearch.ca](mailto:info@smtresearch.ca)