

**Addressing the Water Intrusion Problem  
In Building Construction**

**Submitted to the State of Oregon  
Construction Claims Task Force**

**By J. Duncan Townsend  
Vice President and Co-Founder of Detec Systems**

**May 9, 2006**

# Addressing the Water Intrusion Problem in Building Construction

The majority of construction-defect claims stem from water intrusion into buildings. Concealed water intrusions that accumulate undetected in the building envelope cause physical property damage and mold growth. This in turn leads to construction defect claims, increased loss ratios, lost productivity, unnecessary expenses and injured reputations.

An automated, permanent structure monitoring system holds the key to solving a large part of this vexing construction issue. This new application of proven technology is grounded in building science to offer innovative solutions to this complex problem. The instrumentation, until recently, was too expensive to consider for broad commercial application however, it is now affordable.

By detecting concealed accumulations early, a Moisture Detection and Monitoring System (MDMS) delivers vital information for avoiding unnecessary repairs and costly damage. The negative legal, health and environmental issues can be prevented and most construction-defect claims can be avoided.

## Background

The Oregon State Construction Claims Task Force (CCTF) has received testimony from a host of highly qualified professionals including Building Science/Forensic Engineers, Design Professionals, Property Development Consultants and Owners. The single most prevalent problem acknowledged by each group is that of water intrusion into buildings. The Task Force attributes the source of this problem to one or more of four broad categories:

1. Design errors and omissions
2. Construction defects
3. Material deficiencies
4. Maintenance oversights

The multifaceted nature of the water intrusion problem becomes obvious when one analyzes the list of ten concepts proposed to solve the issue as described in the *Construction Claims Task Force Concept Papers April 5, 2006*. This list makes it clear that reducing the risk of water intrusion and resultant claims is a worthy goal, however, eliminating the risk is virtually impossible.

## Contributing to the Solution

Automated, permanent structure monitoring will contribute to the solution of water intrusion sought by the CCTF in several ways. The concepts as listed in the *Construction claims Task Force Concept Papers*, are:

1. **Concept #4 - Contractor Bonding.** The loss control provided by continuous structure monitoring will significantly reduce the number and severity of claims. This will allow bond issuers to improve their loss ratios and to remain profitable while lessening the burden of bonding on contractors.

Since monitored buildings present the risk of fewer claims, bond issuers can safely increase bond amounts on MDMS- equipped buildings for the same rates previously offered for less coverage. Similarly, contractors who install structure monitoring in their projects will

reduce the likelihood of incurring a claims history that inevitably raises their bonding burden. The benefits of this risk mitigation are obvious in the condominium market.

**2. Concept #5 - Building Code Amendments. Option 5A: Develop Minimum Building Envelope Design Standards Including Use of a Drainage Cavity.** Rainscreen technology represents good building science however, as long as we continue to penetrate the envelope with windows, doors, vents and through-wall fasteners, the sealing and flashing details will continue to cause most of the failures. Our experience demonstrates that drainage cavities are a good idea but they are not the panacea- they do not solve the problem. Continuous monitoring assures the efficacy of this construction approach. It reveals whether the envelope is performing as intended. When water intrusions are detected, they can be addressed in a timely manner to avoid larger problems later.

**3. Concept #5 - Building Code Amendments. Option 5C: Require Moisture Content not to Exceed a Defined Level Before Closing The Wall Cavity.** One of the key benefits of the MDMS is that low voltage electricians install the moisture sensing devices in the wall cavity during construction. This allows moisture reports to be issued prior to the drywall application and prior to the enclosure of excessively wet areas. The system technicians notify the contractor of specific wet locations that need to be dried. To assist the contractor further, the system monitors drying efforts and signals when the wall is sufficiently dry and ready for closure.

The MDMS applies the electrical resistance method to monitor the sheathing moisture content according to industry standard. These measurements are collected from a unique moisture detection tape applied within the wall cavities. The instruments monitor the entire perimeter and all penetrations of the building envelope. Hard wiring of the system components assures long-term reliability.

**4. Concept #6 - Best Practices Guidelines. Option 6A: Develop and Mandate the Use of Best Practices or Guidelines as Part of the Minimum Code Requirement and 6B: Develop and Make Available Best Practice Guidelines.** Moisture Detection and Monitoring Systems should be mandated for installation in multifamily and commercial structures as a means of avoiding major moisture-related damages and insurance claims. The technology is highly effective and easily affordable for these types of construction. While the fixed costs make it expensive for scattered single-family homes, new single-family subdivisions can enjoy the benefits for reasonable costs.

*Detec Systems currently collaborates with the National Research Council's Institute for Research in Construction (IRC) on building science projects. "IRC's Building Envelope and Structure Program has attained an international reputation for its expertise on building envelope systems. As Canada's leading authority in this field, its research is directed toward developing and applying technologies for the design, construction and operation of durable, energy-efficient and cost-effective envelope systems. Part and parcel of the program is a strong emphasis on the structural aspects of buildings. The research applies to both new construction and repair or renovation, for all types of buildings.*

*Drawing upon staff expertise in materials science, structural engineering and building science, IRC treats the building envelope as a system to address the critical elements that affect performance, durability and life-cycle costing”<sup>1</sup>.*

**5. Concept #7- Quality Control Measures. Option 7A: Require Designers to Focus on Resisting Water Intrusion.** In addition to focusing on resisting water intrusion, designers should also specify permanent moisture detection and monitoring systems to assure that the buildings do in fact perform as they are intended to perform.

The success of designs that resist water intrusion are limited by:

1. Construction or execution of the details
2. Materials and components used to build the structure
3. Maintenance or lack thereof and,
4. Natural forces such as seismic activity of severe wind loads

Natural forces are the wild card that often compromise sound designs, good construction and proper maintenance. A watertight building prior to any of these events can begin to leak water into the hidden wall cavities and roof areas. When the MDMS detects these events, technicians will communicate the circumstances to the property manager. After the manager corrects the situation, the system continues monitoring in order to determine the effectiveness of the corrections. Continuous structure monitoring is a compelling quality-control mechanism as well as a highly efficient long-term maintenance tool.

**6. Concept #7- Quality Control Measures. Option 7B: Require On-site Assurance of Work.** MDMS technicians, working on-site during construction, issue monitoring reports to determine the suitability of wall cavities and ceiling areas for closure. These reports can and should be available to the design professional, envelope consultant and contractor during construction in order to prevent water intrusions from being “built in”. Defects identified by the system after the wall closure can be corrected before the contractor turns the building over to the owner. This saves the owner and contractor the expense and aggravation of callbacks.

**7. Concept #7- Quality Control Measures. Option 7C: Require Third-Party Inspections of Building Envelope Methodologies.** Structure monitoring is intended to function as a critical information resource for the third-party inspector- not as a replacement for the services rendered by this professional. The unique information supplied by the MDMS enables the envelope engineers to deliver quality services to their client.

The comprehensive nature of contiguous perimeter monitoring provides far more relevant data than manual, random sampling methods of moisture contents will. The MDMS allows one to “see” the actual real-time performance of the envelope instead of depending on assumptions extrapolated from a limited number of scattered sampling points. This radically different method of monitoring delivers vital information to enable envelope engineers to evaluate more accurately the water intrusion issues. These improved evaluations yield better recommendations to the parties charged with correcting the problems.

**8. Concept #9 - Consumer Education Related to Maintenance.** The importance of proper maintenance to sustain buildings cannot be understated. Avoiding the accumulation of moisture in the wall cavities should be the key goal. The MDMS is designed to operate for

---

<sup>1</sup> The NRC-CRNC Institute for Construction Research web site [http://irc.nrc-cnrc.gc.ca/bes/index\\_e.html](http://irc.nrc-cnrc.gc.ca/bes/index_e.html)

over 40 years. It serves as a highly effective maintenance tool for the design life of the building. The property owners are the long-term beneficiaries of the monitoring services.

Numerous industry standards emphasize the need for routine maintenance and inspection to ensure the performance of the building for the duration of its design life. One of those standards, ASTM E241 *Standard Guide for Limiting Water-Induced Damage to Buildings* introduced the concept of “Critical Moisture Content” and “Critical Cumulative Exposure Time”. Detec applies these and other industry standards to shape the guidelines for interpreting the information gathered by the MDMS. The monthly reports issued to property managers clearly and concisely show any areas of concern accompanied by guidelines for appropriate responses.



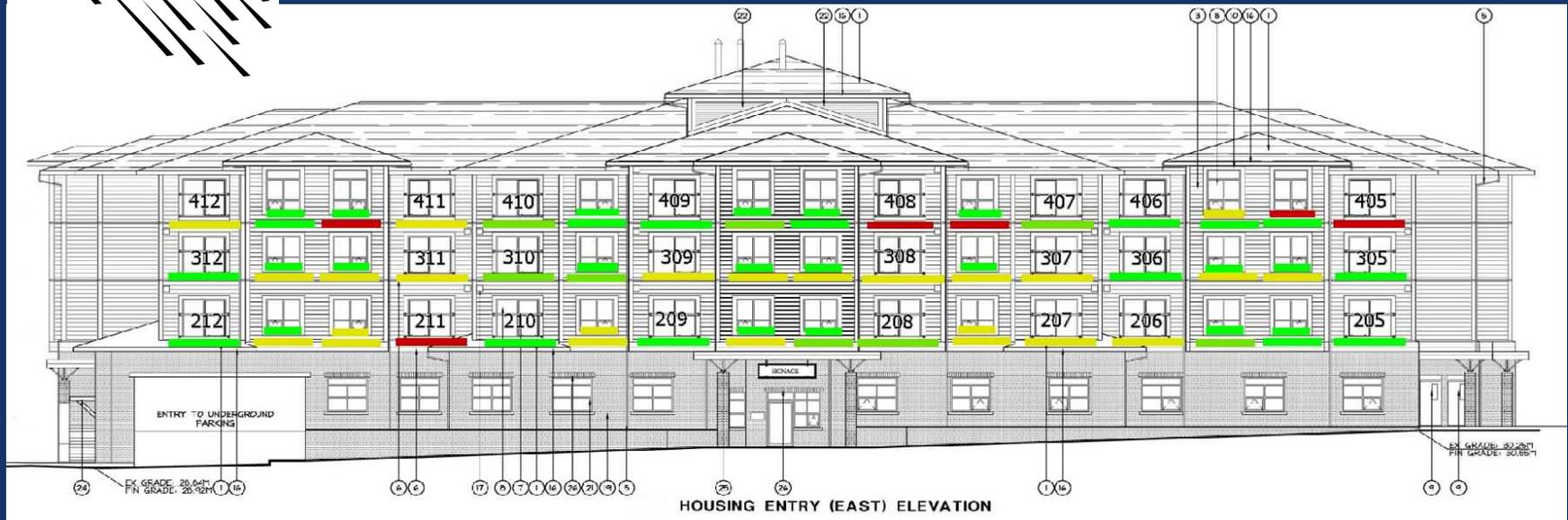
- 43 Unit wood framed seniors residences
- Moisture Detection and Monitoring System installed
- IAQ sensors installed in first floor care unit



STRUCTURE MONITORING TECHNOLOGY



# MDMS ENVELOPE REPORT – EAST ELEVATION

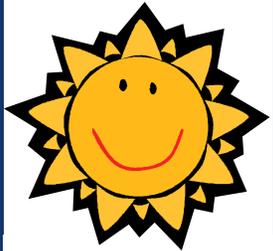


January 8, 2006

|  |         |                  |
|--|---------|------------------|
|  | GOOD    | Less than 20% MC |
|  | CAUTION | 20 to 28 % MC    |
|  | HIGH    | 28+ % MC         |



STRUCTURE MONITORING TECHNOLOGY



# MDMS ENVELOPE REPORT – EAST ELEVATION



February 17, 2006

|  |         |                  |
|--|---------|------------------|
|  | GOOD    | Less than 20% MC |
|  | CAUTION | 20 to 28 % MC    |
|  | HIGH    | 28+ % MC         |



STRUCTURE MONITORING TECHNOLOGY