



# INSIGHT™

ISSUE NO. 10

A technical newsletter by Rath, Rath & Johnson, Inc. for the construction industry.

**“Insight: to see into and understand; an item of knowledge gained by this power.”**

In this issue of *RRJ Insight*, we highlight project work, services, and professional activities related to the firm’s expertise with building facade evaluation, testing, and renovation. Profiled herein is the Sea Colony East condominium complex located in Bethany Beach, Delaware. RRJ has provided structural and architectural engineering services on behalf of unit owners of the oceanside multi-unit recreational community for over a decade. This issue also focuses on RRJ’s expertise in the area of applied building sciences with a feature article on water leakage tests and announcement of the new ASTM symposium proceedings, STP 1314, co-chaired by Dr. Robert J. Kudder.

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Dr. Kudder  
Co-Chairs ASTM  
Symposium on  
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# Project Profile

## Coastal High-Rise Rehab

Sea Colony East condominium complex is a beach front property located in Bethany Beach, Delaware. **The nine high-rise multi-family buildings are situated within a hundred yards of the Atlantic Ocean.** The buildings have concrete frames with steel stud in-fill, and were originally clad with plywood panels coated with an exposed aggregate finish.

RRJ was retained by legal counsel for several of the Owner Associations to investigate leakage, material degradation, and structural problems. **RRJ's investigation revealed numerous deficiencies** including: water infiltration in the cladding system, insufficient wind load support in the stud system, deterioration of exposed concrete balconies and walkways, and building code violations.

Following the investigation and system evaluations, RRJ prepared conceptual repair schemes to address the deficiencies identified. The conceptual repairs were the basis for determining budgetary project costs, which provided the basis for a general approach to repair a number of the buildings. RRJ's remediation designs included, among other things, replacement of the existing cladding system, reinforcement of the existing steel stud work, and concrete repairs.

**The existing plywood cladding system was replaced using composite non-combustible panels with exposed aggregate to maintain the original architectural expression while meeting applicable codes relating to fire ratings.** The existing steel stud system was reinforced to provide the lateral support required for oceanfront wind loadings determined through wind tunnel testing and analysis.



*Sea Colony condominium complex near the Atlantic Ocean.*

The exposed concrete on the balconies and walkways on one of the buildings was severely deteriorated, with a large percentage of the reinforcing steel exposed and corroding. Available funds prohibited the complete removal of the top surface of the concrete, so a “patch and membrane” program was initiated. All delaminated and spalled concrete was removed and replaced with high performance concrete. Areas with reinforcing steel exposed were built-up to provide adequate concrete cover to protect the steel. Upon completion of the concrete restoration, a liquid urethane membrane was applied over the top surface and edges of the exposed concrete slabs. The membrane provides additional protection of the repaired concrete from new chloride contamination by wind-blown sea water, as well as aesthetic benefits.

At the Owners' request, exterior grade carpeting was installed on the oceanside exposed balconies. Carpeting on balconies can often trap moisture in concrete slabs, and lead to premature deterioration of the concrete and reinforcing steel. To combat this, RRJ designed a carpet installation that would minimize prolonged moisture exposure against the concrete.

**RRJ has been engaged in evaluations and remediation projects at Sea Colony for over a decade now.** Other enhancements within the complex have included new metal roofs, window/sliding glass door replacements, correction of railing attachments, and code conformance for fire safety.

- Brian Faith, AIA

# Tech Tip

## Water Infiltration Testing: Hose vs. Chamber Testing

Currently, there are two field test methods commonly used for determining resistance to water penetration for exterior windows, curtain walls, storefronts, sloped glazing systems, and doors. The first test method is the Architectural Aluminum Manufacturers Association (AAMA) 501.2, *Field Check of Metal Storefronts, Curtain Walls, and Sloped Glazing Systems for Water Leakage*. This method is intended for those joints which are designed to be permanently closed or watertight. The method is often referred to or described as the **Hose Test Method** because the procedure involves the use of calibrated hose nozzle to deliver water to the test specimen at prescribed pressures. The test procedure consists of systematically wetting the test specimen with water from the spray nozzle which is held at a distance of 12 inches from the joint. The nozzle is moved slowly back and forth above the joint covering approximately 5 lineal feet of joint during a 5 minute period.

The second test method is described in American Society for Testing and Materials (ASTM) E-1105, *Field Determination of Water Penetration of Installed Exterior Windows, Curtain Walls and Doors by Uniform or Cyclic Static Air Pressure Difference*. This method is not limited by joint or fenestration type and is useful for determining the in-place performance of a specimen when subjected to a prescribed rate of wetting under a defined static pressure difference. This method is often referred to as the **Chamber Test Method** because it requires that a test chamber be installed either on the exterior or interior side of the test area. The test procedure consists of delivering water to the exterior from a calibrated spray rack at a minimum rate of 5 gal/ft<sup>2</sup>/hr while simultaneously applying a specified differential pressure across the specimen.

The test can be performed for a duration of 15 minutes of static pressure or in a cyclic procedure in which the differential pressure is applied for 5 minute durations with 1 minute interruptions of no differential pressure and only water spray.

Because both the hose test method and chamber test method can be used to evaluate leakage through or around a fenestration system, a frequently asked question is, “**Which method should be used for which application?**” To answer this question, one must consider the reason or intent of the testing. For example, is the need for the test to verify existing leak paths, is it to verify compliance with a project specification or industry standard, or is it a quality assurance and performance check for a new installation. In addition, one must

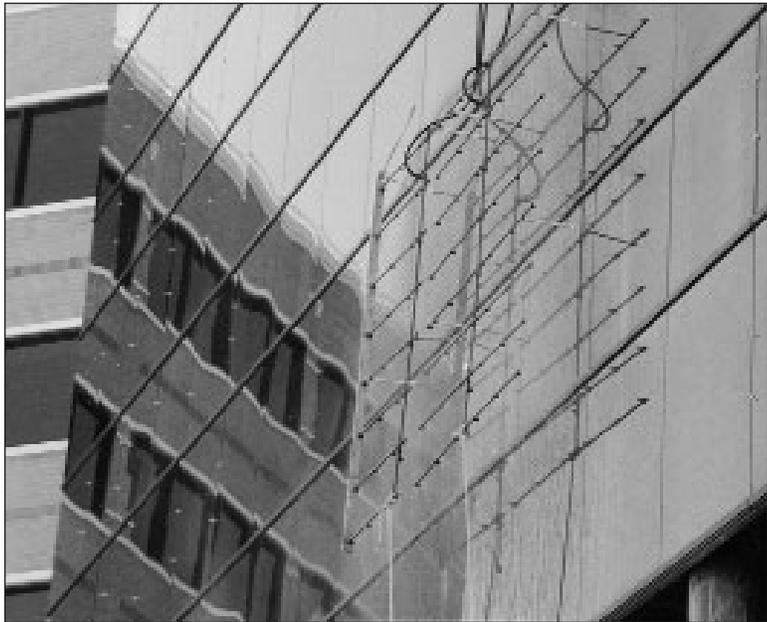
consider the advantages and limitations of each method.

### Hose Test Method

- Is intended for non-operable joints
- Is a dynamic type water test
- Simulates water penetration forces such as:
  - Kinetic Energy
  - Gravity
  - Surface Tension
  - Capillary Action
- Does not simulate water penetration forces such as:
  - Air Currents (percolation)
- Is a good method for determining known leak paths and trouble shooting
- Is an accepted method for performing field quality assurance testing
- Is generally less expensive than chamber testing



AAMA 501.2 hose testing.



*ASTM E-1105 water spray rack.*

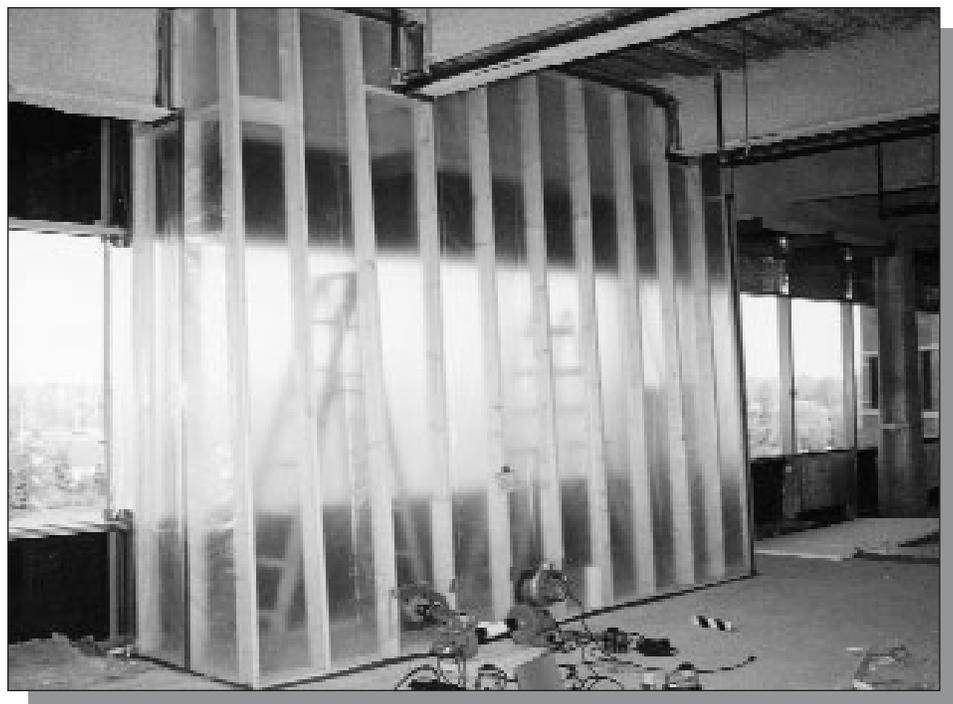
Both test methods have distinct advantages and general limitations. A failure to fully understand these by any party that is involved with or impacted by the results of a test can result in unrealistic expectations and/or false assurances. **A thoughtful analysis of the specific project goals and requirements should be made prior to selecting or specifying a water penetration test method.** Consultants and testing laboratories such as RRJ that are experienced with conducting these tests are available to provide further information and assistance.

- Brian Faith, AIA  
- Kenneth M. Lies, AIA

For additional information on hose testing refer to the Lab News articles in *RRJ Insight Issue 1 and Issue 6*. Additional copies are available upon request.

### **Chamber Test Method**

- Uses the same test methodology followed for product certification and determining water penetration performance ratings
- Simulates water penetration forces such as:
  - Pressure Difference (static/cyclic)
  - Gravity
  - Surface Tension
  - Capillary Action
  - Air Currents (percolation)
- Does not simulate water penetration forces such as:
  - Kinetic Energy
- Is a good method for diagnosing water penetration that occurs under wind driven rains
- Can be much more expensive than hose test method
- Requires more specialized testing equipment and instrumentation
- Is an accepted method for performing field quality assurance testing
- Includes the effects of load deformation on system components.



*ASTM E-1105 interior test chamber.*

# *Raths, Raths & Johnson, Inc.*

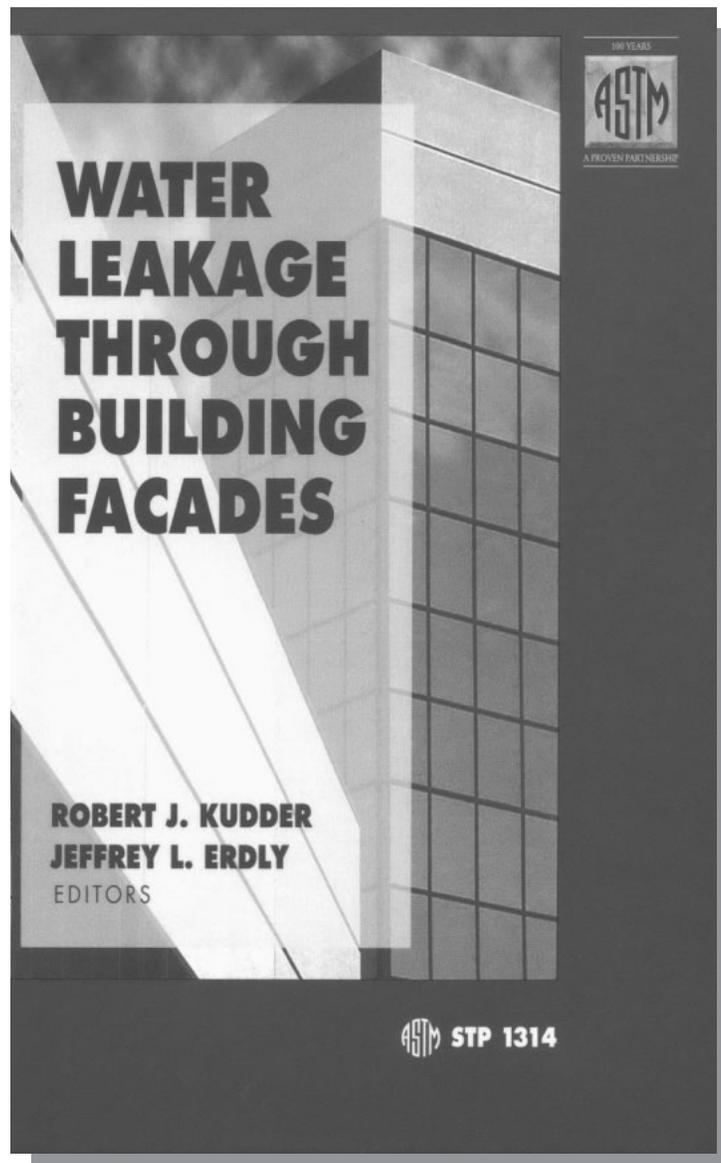
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## Dr. Kudder Co-Chairs ASTM Symposium on Water Leakage

RRJ, has gained national recognition for expertise dealing with the investigation and repair of building leaks. In addition to publishing technical articles and making presentations about building leakage, many of our staff are actively involved in professional organizations such as the American Society for Testing and Materials (ASTM), the American Society of Civil Engineers (ASCE), The Masonry Society (TMS), EIFS Members Association (EIMA), which prepare standards, practices and guides for testing and evaluation procedures.

In March 1996, Dr. Kudder co-chaired an ASTM Symposium on Water Leakage Through Building Facades. This symposium was the second in a series sponsored by ASTM Committee E06 - Building Performance, Subcommittee E06.55 and Task-group E06.55.15 - Water Leakage which is chaired by Dr. Kudder. Building specialists from the United States, Canada and Singapore presented papers and exchanged information on the characteristics of wind-driven rain, testing and quality control procedures, wall repairs, and case studies. Two of the papers presented were by RRJ staff: Hoigard, K.R. and Kudder, R.J., *The Facts About Hose Testing*, and Lies, K.M. and Faith, B.A., *Window Detailing Considerations for Leakage Prevention*.

ASTM has just published the proceedings of the symposium as STP 1314. This STP, together with others in their series, provide a compilation of peer-reviewed technical papers on current thinking and developments in the art and science of leakage evaluation, repair and prevention.



# Professional Services

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## Design

Structural  
Restoration  
Renovation  
Architectural  
Curtain Wall Redesign  
Historical Preservation  
Material Failure Redesign

## Investigation

Leakage  
Failure/Collapse  
Tolerance Evaluation  
Cladding Performance  
Expert Witness Service  
Material Evaluations  
Specification Conformance

## Testing

Onsite Testing  
Instrumentation  
Laboratory Testing  
Material Properties  
Performance Analysis  
Full Scale Load Testing  
Manufactured Products

## Client Services

Model Building  
Dispute Resolution  
Courtroom Exhibits  
Document Reviews  
Job History Reconstruction  
Cause/Fault Determination  
Litigation Support

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**RRJ** is available to help you with any questions you may have regarding our services or a specific article in our newsletter.

For additional information call:

Ms. Barbara J. Smith, S.E., P.E.  
at 1-800-826-6822



**Raths, Raths & Johnson, Inc.**  
835 Midway Drive  
Willowbrook, Illinois 60521-5591

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