

# Prevent Leaking Buildings

## Specifying Superior Envelope Performance



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Welcome to **Architecture Exchange East 2011**

# Specifying Superior Envelope Performance

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**Virginia Society** **AIA**



Learning Objectives:

# Specifying Superior Envelope Performance

Participants will be better able to:

- Identify common contracting practices that inhibit properly coordinated building envelope construction
- Utilize industry resources supporting high performance building envelope design and construction
- Specify installer qualifications that reflect industry best practices for building envelope air and moisture control
- Enforce building envelope quality assurance and quality control
- Provide long-term facility owner protection against leaks
- Enhance LEED-NC and LEED-EB certification



"What we have here is a failure to coordinate."

# Our buildings leak



HOME / NEWS / LOCAL

## MIT sues Gehry, citing leaks in \$300m complex

Blames famed architect for flaws at Stata Center

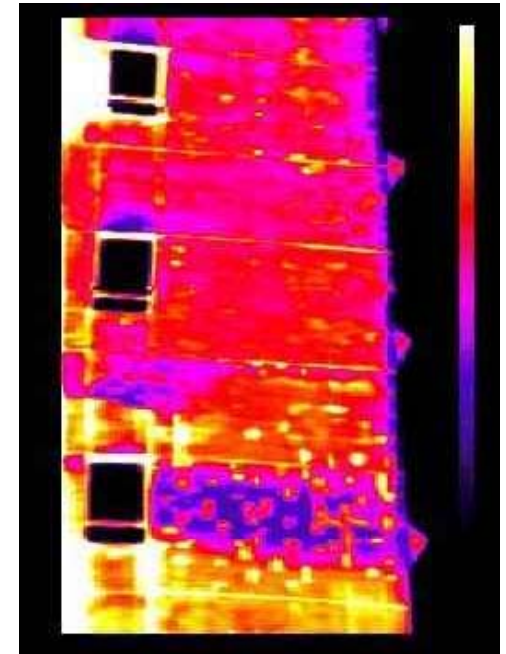


MIT's \$300 million Stata Center in Cambridge, designed by architect Frank Gehry, was completed in the spring of 2004. (mark wilson/globe stafffile 2007)

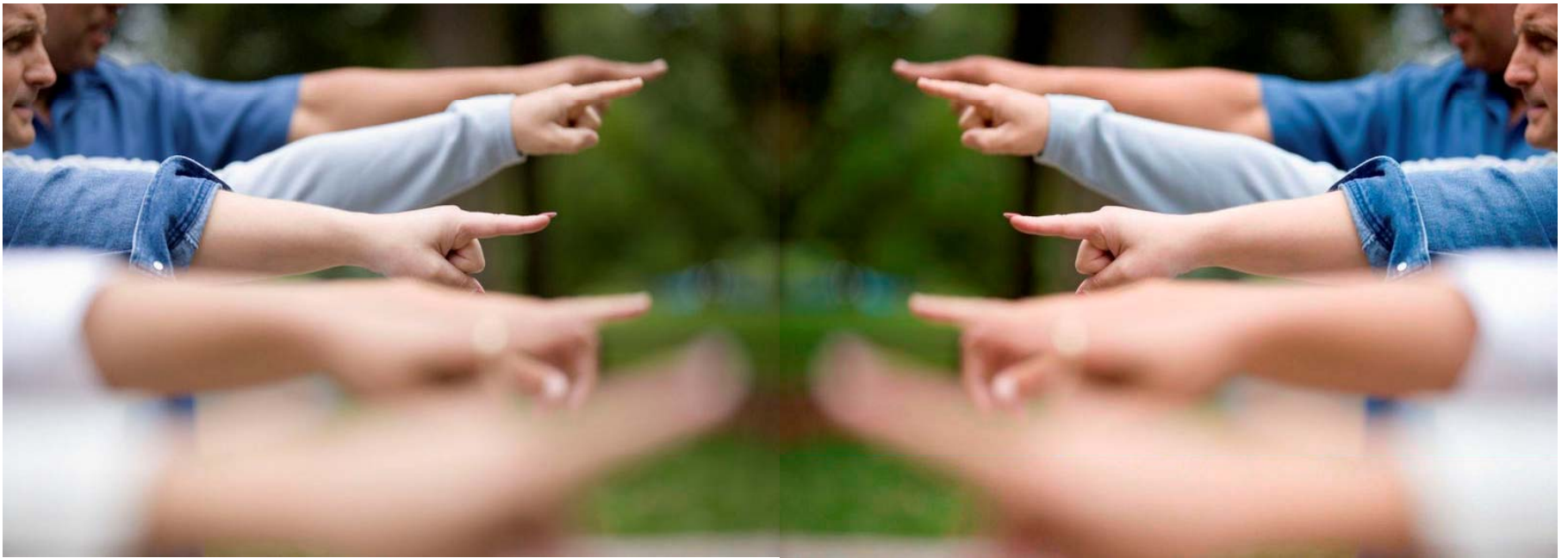
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By Shelley Murphy  
Globe Staff / November 6, 2007

The Massachusetts Institute of Technology has filed a negligence suit against world-renowned architect Frank Gehry, charging that flaws in his design of the \$300 million Stata Center in Cambridge, one of the most celebrated works of architecture unveiled in years, caused leaks to spring, masonry to crack, mold to grow, and drainage to back up.



# Everyone dodges responsibility



Our facility owners and occupants expect better



We already have what we need

# We Have the Ingredients for Success

Time-tested building envelope details and standards  
Building science contributes performance knowledge  
Reliable moisture and energy management products  
Qualified installers

# Time-Tested Details and Standards

Industry organizations publish proven details and standards

- NRCA
- FMG
- ASTM
- ANSI/SPRI
- SMACNA
- ASHRAE
- ABAA

# Building Science and Performance Knowledge

- National Institute of Science and Technology
- National Institute of Building Science
- Whole Building Design Guide
- BuildingScience.com
- Building Enclosure Council network
- ABAA
- Laboratory testing
- On-site testing and inspection

NISTIR 7238

## Investigation of the Impact of Commercial Building Envelope Airtightness on HVAC Energy Use

Steven J. Emmerich  
Tim McDowell  
Wagdy Anis

**NIST**  
National Institute of Standards and Technology  
Technology Administration, U.S. Department of Commerce

# High-Performance Building Envelope Products

Manufactured products offer improved moisture management and energy savings

- Waterproofing membranes
- Roofing systems
- Air barrier systems
- Vapor retarders, flashings, and sealants
- Insulation

*and*

- complimentary HVAC humidity controls

# Qualified Installers

Experienced specialty firms with record of successful performance

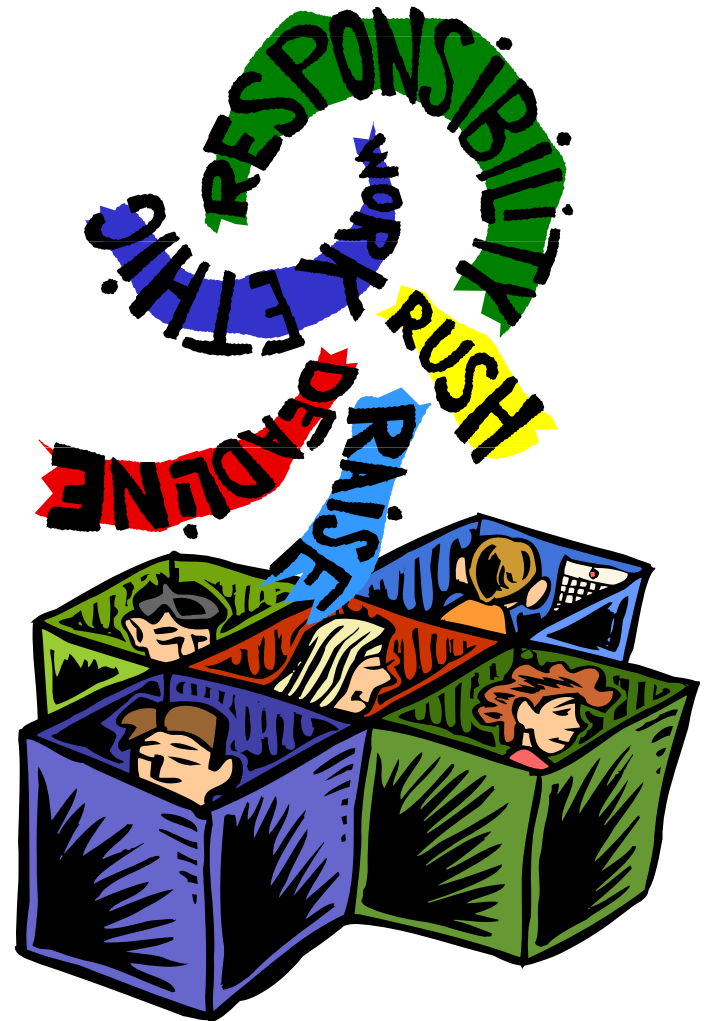
- Manufacturer-trained installers
- Manufacturer technical field support
- Industry installer certifications
  - FMG
  - AABA
  - AWCI
  - RCI



# Plenty of Experts

Multitude of designers involved in moisture and energy management

- Architect's in-house experts
- Architect's MEP engineer consultants
- Architect's envelope consultants



# Plenty of Experts

Multitude of consultants focused on envelope quality requirements

- Contractor's envelope consultants
- Testing and inspection agents
- Commissioning Authorities

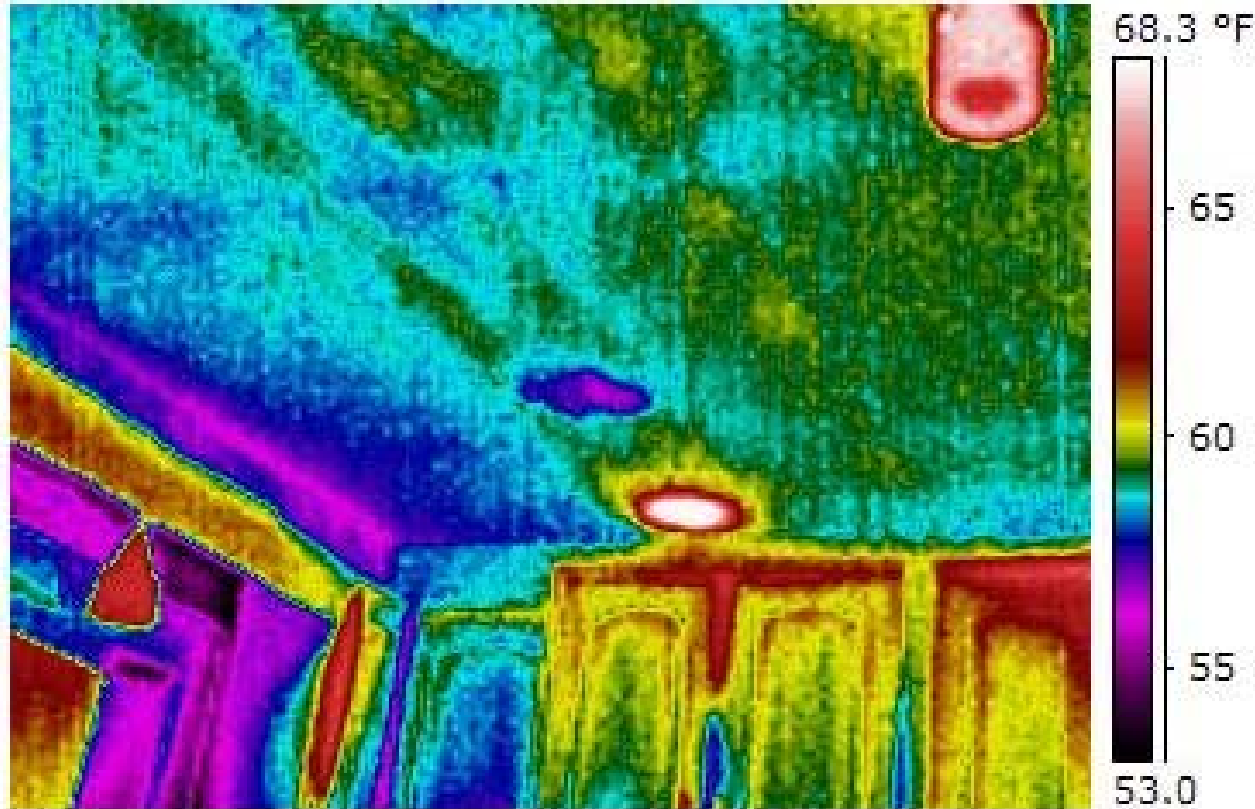
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# Why Do Buildings Still Leak?

# Why Do Buildings Still Leak?

Moisture leaks and energy leaks are still common despite all our resources and understanding



# Envelope Failures: No one's in charge on site

Designers and consultants and knowledge aren't enough to ensure building envelope quality



# Envelope Failures: No one's in charge on site

## General Contractor as broker

- GC + 12 subcontracts + 15 manufacturers

## Construction Manager as scheduler

- CM + 6 to 12 trade contracts + 15 manufacturers

## Design-builder as developer

- D-B + 6 to 12 subcontracts + 15 manufacturers

*As long as you can point fingers, there's little risk or quality incentive.*

# The New Rule of Three

We have trained the construction industry:

- We will have it fast
- We will have it cheap
- But we can't have it good ...

*Low quality doesn't work for the building envelope!*

# Envelope Failures: The Tower of Babel

No knowledgeable entity at risk and in control

- Specifications are flawed
- Requirements not enforced
- Industry has failed to deliver

*Everybody has wiggle room*



# Envelope Failures at the Interfaces

## Leaks occurring at component interfaces

- "Building Enclosure Council-affiliated envelope forensic specialists concur that the majority of building envelope leaks investigated occur at the interface between envelope subsystems."



# Envelope Failures Impact Energy Performance

Leaks undermine building energy performance expectations

- *"Many "green" buildings don't save energy. Why? They have too much glass, they are over-ventilated, they are leaky to air, they are fraught with thermal bridges ..."*  
Joe Lstiburek, PhD., [buildingscience.com](http://buildingscience.com)

# A solution to the leak problem

We're here to talk about a solution

Single-source responsibility on-site

No leaks

Warranty with Extended Service

# A Solution

## The Building Envelope Contractor



# The Building Envelope Contractor

A single umbrella specialist trade contractor for the building envelope

- Trade contractor for Construction Manager and design-builder
- Subcontractor for General Contractor



# The Building Envelope Contractor

## **SECTION 013513 - SPECIAL PROJECT PROCEDURES FOR BUILDING ENCLOSURE**

### **PART 1 - GENERAL**

#### **SUMMARY**

1. Section includes responsibilities for a single-source Building Enclosure Specialist Installer (BEC) for building enclosure work.

# The Building Envelope Contractor

**Building Enclosure Specialist Qualifications:** An experienced installer of building enclosure products who has completed building enclosure work installations similar in material, design, and extent to that indicated for Project, and whose work has resulted in construction with a record of successful in-service performance, and meeting the following requirements:

1. Experienced in administration and supervision of building enclosure work and integration of its various components.
2. An employer of workers trained and certified by individual product manufacturers and industry associations.
3. An employer of a qualified supervisor.

# The Building Envelope Contractor

Building enclosure work required by, but not specified in, this Section includes the following:

1. Division 07 Section "Self-Adhering Sheet Waterproofing."
2. Division 07 Section "Thermal Insulation."
3. Division 07 Section "Vapor Retarders."
4. Division 07 Section "Water-Drainage Exterior Insulation and Finish System ."
5. Division 07 Section "Fluid-Applied Membrane Air Barrier."
6. Division 07 Section "SBS-Modified Bituminous Membrane Roofing."
7. Division 07 Section "Flexible Flashing."
8. Division 07 Section "Sheet Metal Flashing And Trim."
9. Division 07 Section "Joint Sealants."
10. Division 08 Section "Aluminum-Framed Entrances And Storefronts."
11. Division 08 Section "Aluminum Windows."
12. Division 08 Section "Glazing."

# The Building Envelope Contractor

Specifications require use of specialist to deliver functional building envelope

- Provides completed building envelope
- All moisture- and thermal- critical elements
- Meets performance requirements
- Employs qualified employees and subcontractors
- Procures compatible materials
- Performs and coordinates quality assurance
- Performs and coordinates field quality control
- Furnishes comprehensive, single source performance warranty



Here's where the specs come in

# Qualified Personnel

## Installers with industry certifications

- Qualified subcontractor installer firms and employees
- Experienced supervisors at subcontractor level
- Certified inspectors as part of BEC team

*Put quality responsibility back with the Contractor!*

# Qualified Personnel

**Qualifications:** Qualified field technical personnel experienced in observations and inspection of components of the building enclosure, with the following qualifications:

1. Certified as a Registered Roof Observer by RCI International (RCI).
2. Certified as Air Barrier Installer by Air Barrier Association of America (ABAA).
3. Certified as EIFS Inspector by the Association of the Wall and Ceiling Industry (AWCI).
4. Certified as Installer by American Window and Door Institute.
5. Certified as Installer or Inspector by manufacturer of waterproofing system.

# Control of Procurement

## Building Envelope Contractor

- Selects products meeting specification requirements
- Ensure field compatibility of envelope products
- Obtains manufacturer approval of related products

# Compatible Materials

**Product List:** Provide list of products to be incorporated in building enclosure work under Sections listed in Summary Article.

1. Indicate products of separate manufacturers that will be in contact with one another. Indicate interfaces of materials on Coordination Drawings.
2. Submit individual manufacturers' certification indicating products as proposed are compatible.

# Quality Assurance

## Coordination drawings

- Detailed interfaces between separate shop drawings
- Multiple party signoffs

## Preinstallation conferences

## Assembly Mockups

# Quality Assurance

**Coordination Drawings:** Prepare and submit Project-specific Coordination Drawings, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved. Include the following information, as applicable:

1. Refer to individual sections for specific Shop Drawing requirements for Building Enclosure products and equipment. Show interfaces and relationship of components shown on separate Shop Drawings.
2. Include details of treatment of penetrations in building envelope by work of other Sections.
3. Show dimensions and clearances of interrelated Building Enclosure work.
4. Indicate required installation sequences of interrelated Building Enclosure work.
5. Include information necessary for interface with other building components.

# Quality Assurance

## Preinstallation conferences

- Involve all affected parties
- Review
  - Specification and drawing requirements
  - Shop drawings and coordination drawings
  - Reference standards
  - Manufacturer's instructions
- Coordinate
  - Assembly mockups
  - Testing

# Quality Assurance

## Assembly mockups

- Requirements for integrated exterior wall mockup in Division 01
- Incorporate backup, air barriers, cladding, opening types, penetrations, flashings, joint treatment
  - Include wall/roof junction
- Configure to allow for observation and inspection

# Quality Control

## Ongoing inspection

- Substrate examination and correction
- Verification of environmental conditions
- Verification of manufacturer installation recommendations
- Photo documentation of concealed work



# Quality Control

**Reports:** Prepare inspection reports and indicate compliance with and deviations from the Contract Documents.

1. Perform additional inspections to determine compliance of replaced or additional work. Prepare inspection reports.
2. Prepare field quality-control certification that states installed building enclosure work complies with requirements in the Contract Documents.

**Photographic Documentation:** Provide digital photograph documentation of building enclosure work to be concealed at a scale and quantity acceptable to the Owner that visibly demonstrates compliance with application requirements. Label documentation sequentially to indicate location on building envelope and elements included.

# Quality Control

## Component testing

- Waterproofing: Flood testing
- Wall openings and flashings: Water spray testing
- Joint sealant testing



# Performance Requirements

BEC fulfills objective, field-verifiable building performance

- Fan door testing
- Thermographic examination



# Performance Requirements

**Full Building Testing:** Coordinate full building testing to verify Project meets performance requirements specified in Division 01 Section "Exterior Enclosure Performance Requirements."

No leaks. We promise.

# Building Envelope Performance Warranty

## Moisture and Energy Management Warranty

- Transfer Owner's leak risk to the Contractor
- Renew critical exposed envelope elements
- Monitor energy usage
- Renewable term



# Building Envelope Performance Warranty

**Special Project Warranty:** Submit Building Enclosure Specialist Installer's warranty, on warranty form at end of this Section, signed by Building Enclosure Specialist Installer and Contractor, covering the Work of this Section, including all components specified in individual specification Sections listed in Summary Article, in which Installer and Contractor agree to repair or replace components of building enclosure that fail in materials or workmanship within specified warranty period.

Failures include:

1. Measured air infiltration in excess of performance requirements.
2. Failure to remain weathertight condition, including leaks.
3. Warranty Period: [10] years from date of Substantial Completion.

# Building Envelope, Sustainability, and LEED

# Sustainable Building Envelope Performance

Renew moisture protection systems as part of warranty service

- Periodic inspection and correction of defects in exposed elements
- Meet requirements for renewal of LEED-EB certification



# Sustainable Building Envelope Performance

**Warranty Service:** During the warranty period, Building Enclosure Specialist Installer shall examine exposed components of building enclosure work annually and carry out maintenance responsibilities for preservation of warranty. The cost of annual inspections is included in the Contract Sum.

# BEC Impact on LEED Credits

## Innovation credit

- Innovative Building Envelope QA/QC
- Incorporate envelope in commissioning
- Exceed post-construction monitoring



# BEC Impact on LEED Credits

## Enable LEED-EB re-certification

- EA Credit 1 Optimize Energy Performance through energy-saving maintenance and rehabilitation of building envelope components
- EA Credit 3.2 Building Operations and Maintenance: Building Systems Maintenance



## Summary

# Specifying Superior Envelope Performance

The BEC: A solution to leaking buildings and pointing fingers resulting from fragmented project delivery

- Specify single source onsite responsibility for building envelope
- Reduce multitude of contracts, installers, manufacturers
- Utilize qualified entity with defined responsibilities and risk
- Provide one-source warranty to Owner
- Provide for continuing monitoring and renewal
- Deliver projects that meet Owner moisture and energy performance expectations



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