Boston Chapter

CSI Boston Technical Paper No. 1: Specifying Air Barriers

07 27 00 - Air Barriers

TABLE OF CONTENTS

Click on any heading below to be directed to a selected aspect of this topic.

INTRODUCTION

WHY THIS TOPIC NOW?

Materials designated as air barriers have been used in buildings in the United States for over a decade, a concept that has been gaining nation-wide acceptance in recent years. Massachusetts was the first state to require air barriers in its building code with the 2001 update of Chapter 13, the energy code. Provisions requiring air barriers in ASHRAE 90.1-2010 brought national attention to the need to control air leakage, leading to requirements for air barriers in the 2012 International Energy Conservation Code (IECC).

Initially, the concept of airtight construction met with much resistance, due to the widespread belief that building enclosure systems relied on air leakage to "breathe" in order to dry out, or that buildings needed air leakage to provide fresh air. However, research has shown that moisture transport due to air flow into and through the building enclosure system can be a significant source of unwanted moisture within exterior enclosure assemblies transferring exponentially more moisture than is transferred by vapor diffusion, and leading to corrosion, staining, mold and other moisture-related problems. In commercial buildings, fresh air is introduced by the mechanical system, filtered and conditioned, and delivered to the breathing zone of building occupants. Moisture in exterior walls is of particular concern when one face of the wall experiences warm, humid air and the other side is relatively cool and dry leading to the possibility that the air can reach its dew point temperature within the wall construction. Air barrier assemblies can be configured to eliminate the air-borne source of moisture while permitting moisture from other sources to drain or evaporate.

Subsequent research indicates that air leakage also has an impact on building energy usage and other building enclosure performance. Increased heating energy costs of up to 43% and cooling energy costs of up to 33% can be attributed to air leakage in a cold climate (NISTIR 7238, Emmerich, McDowell, Anis, 2005.); poor performance of HVAC and fenestration systems and human discomfort can be caused by air infiltration. These problems can be significantly reduced through the correct use of air barriers.

The design and construction industry has now learned that properly installed air barriers can provide a successful means of conserving energy and managing moisture within building enclosures. This guideline outlines recommendations for specification of air barriers that will most effectively achieve these goals. It focuses on air barriers installed in exterior walls, with recognition of the importance of identifying an airtight plane in all assemblies and inter-connections of assemblies including opaque walls to foundations, fenestration and roofing assemblies.

WHAT ARE AIR BARRIERS?

An air barrier is a material within a building enclosure whose function is to retard air flow between the exterior or unconditioned space within the building and the interior conditioned environment. Air barriers provide a complete airtight enclosure for a building through the use of membranes and other components such as sealants and tapes as needed to maintain continuity along transitions between differing substrates or conditions and seal penetrations through the air barrier.

Construction materials installed for other functions may in some cases also serve as air barriers when appropriately detailed.

Because the air barrier is typically one of several layers within the building enclosure assembly, it is important to remember that the assembly as a whole must control wetting due to several paths by which moisture can enter the assembly in response to climatic differences between the interior and exterior environments. These paths include:

- Liquid moisture ingress from precipitation
- Moisture transport due to air flow (Infiltration or convection)
- Deposition of moisture due to cooling of the assembly below the dew-point
- Vapor migration due to diffusion

Moisture deposition can be effectively controlled via four barriers in the building enclosure assembly.

- Water resistive barrier for protection against, and drainage of, liquid water
- Air barrier for control of air leakage
- Thermal barrier (insulation layer) selected and placed to minimize heat transfer and potential for condensation.
- Vapor retarder for control of water vapor diffusion.

Note that a particular material within the exterior enclosure assembly may serve as one or more of the barriers, depending on its properties and location.

DECISIONS TO MAKE PRIOR TO EDITING PART 2 – PRODUCTS

Control of air leakage in a building requires a continuous air barrier system that comprises air barrier assemblies appropriate to different portions of the enclosure. Each assembly in turn is installed using air barrier membrane and accessory materials. Before examining the materials themselves, it is important to understand how they will contribute to achieving the required airtightness of the whole building.

PERFORMANCE REQUIREMENTS FOR WHOLE BUILDING AIR TIGHTNESS

Air barrier assemblies must be connected to each other to provide a complete airtight enclosure for the building. Continuity demands an air barrier in the wall assembly and roofing system as well as in exterior soffits, exposed foundation walls and other types of construction that comprise the building enclosure.

- A compliance option in IECC-2012 allows whole building airtightness testing according to ASTM E779 or ASTM E1827. The building must meet an air leakage rate of 0.4 cfm/ft^2 (2 L/s•m^2) when tested at a pressure differential of 1.57 lbf/ft^2 (75 Pa). The area of enclosure separating conditioned from exterior or unconditioned space must be calculated, including below grade walls and slabs on grade enclosing conditioned space.
- The U. S. Army Corps of Engineers Protocol requires whole building air leakage rate of no greater than 0.25 cfm/ft^2 (1.25 L/s•m^2) when tested at a pressure differential of 1.57 lbf/ft^2 (75 Pa),

PERFORMANCE REQUIREMENTS FOR AIR BARRIER ASSEMBLIES

Prevention of air leakage through the building enclosure requires that air barrier materials be installed with selected accessory components that will assure the continuity of the air barrier assembly. Performance requirements for the air barrier assembly include:

- **Air Permeance**: The assembly must have an air leakage rate of no more than 0.04 cfm/ft^2 (0.2 L/s•m^2) when tested at a pressure differential of 1.57 lbf/ft^2 (75 Pa), in accordance with ASTM E2357. The air leakage permitted for an assembly is ten times greater than for the air barrier material itself.
- **Continuity**: Air leakage can only be controlled if the air barrier assembly continues across gaps around penetrations and over changing substrates. Distinct assemblies used for exterior walls behind different types of cladding, for foundation conditions and for roofing assemblies, need to be joined with each other as well as with fenestration for a complete airtight building enclosure.
- **Structural support**: In order to withstand both positive and negative pressures due to wind, stack effect and HVAC system operation, the assembly must be secured to a substrate that can transfer the imposed loads to the building structure. The most reliable means of support is a firm bond between the air barrier and the back-up wall assembly. The Air Barrier Association of America (ABAA) recommends a bond strength of at least 16 lbf/in^2, when tested according to ASTM D4541. Membranes that are not adhered to a substrate

must either be fastened at frequent intervals using large washers to prevent tearing, or sandwiched between rigid layers that are secured to exterior framing.

- **Durability**: In order for the air barrier assembly to serve its function for the service life of the enclosure, it must be able to withstand a wide range of stresses without deterioration. Installed membranes and accessory materials, such as tapes and sealants must comply with requirements for strength, durability and flexibility specified for the air barrier membrane.
- **Compatibility**: Each air barrier component must be chemically compatible with materials with which air barrier assembly comes in contact. An adhered membrane must also have adhesive compatibility with materials to which it must bond. Require compliance with AAMA 713.

PERFORMANCE REQUIREMENTS FOR AIR BARRIER MEMBRANES

AIR PERMEANCE OF AIR BARRIER MEMBRANE:

In order to serve as an air barrier, industry standards and codes require that the material identified as the air barrier have an air permeance of no more than 0.004 cfm/ft^2 (0.02 L/s•m^2), when tested at a pressure differential of 1.57 lbf/ft^2 (75 Pa) in accordance with ASTM E2178.

Air barrier membranes must also be tested as part of an assembly, as discussed below under Air Barrier Assemblies.

VAPOR PERMEANCE OF AIR BARRIER MEMBRANE:

Materials that serve as air barriers may also retard the diffusion of water vapor through the materials in the building enclosure assembly. Selection of either an air and vapor barrier or a vapor-permeable air barrier must be based on optimization of moisture control so that any moisture that enters the assembly can drain or evaporate to the exterior of the building. Begin the process of product selection by identifying:

- Climate zone in which the building is located
- Temperature and relative humidity conditions that will be maintained within the building.
- Anticipated construction assemblies planned for the building enclosure.

Hygrothermal analysis using these conditions is required to assess the likelihood of detrimental condensation within the building enclosure due to water vapor diffusion. WUFI software available from Oak Ridge National Laboratory provides a more sophisticated means of predicting moisture transport within the building enclosure than the simple dew point calculation that was performed in the past. WUFI should be used to evaluate wall assemblies for any conditions in which exterior or interior relative humidity may be high.

Results of hygrothermal analysis will determine which one of the following applies to the project conditions

- **Vapor permeable air barrier** allows adequate drying of the moisture sensitive components of the back-up wall from interior to exterior. Under certain exterior conditions, a vapor permeable air barrier will permit water vapor diffusion to facilitate adequate drying. To be

- considered vapor permeable, the vapor permeance of the membrane must be at least 10 Perm or higher when measured in accordance with ASTM E96.
- **Air and vapor barrier** is installed in a location that is warmer than the dew-point of the indoor air, where drying of the backup wall assembly is not required. To be considered a vapor barrier or vapor retarder, the vapor permeance of the membrane must not exceed the code-mandated permeance requirements for the application (Types I, II or III), or the requirements indicated by hygrothermal analysis. Vapor retarders are typically measured in accordance with ASTM E96.

FIRE RESPONSE CHARACTERISTICS OF AIR BARRIER MEMBRANES

Air barrier materials that are combustible must comply with Building Code requirements.

- Material Test: Building codes include requirements for flammability and smoke developed indices in accordance with ASTM E 84, for combustible materials within exterior walls.
- Wall Assembly Test: According to IBC-2012, combustible materials installed as water resistive barriers that also serve as air barriers in most construction types may need to have been tested in the proposed wall assembly in accordance with NFPA 285. Refer to separate resources for a full discussion of NFPA 285 compliance.

ADDITIONAL PROPERTIES OF AIR BARRIER MEMBRANES

For effective control of air and moisture within the building enclosure, the following properties of air barrier membranes play an important role. Refer to the Air Barrier Association of America's web-site (http://www.airbarrier.org/) for performance values required for ABAA acceptance of specific types of membrane.

- Bond strength should be tested for self-adhered membranes, fluid-applied membranes and spray polyurethane foam products in accordance with ASTM D4541, to make sure that they will withstand both positive and negative air pressure due to wind loads, stack effect and fan pressure.
- Tensile strength and elongation are needed to accommodate movement without tearing, where an air barrier bridges across gaps or is adhered to two substrates with different coefficients of thermal expansion.
- Durability is critical for the air barrier membrane to serve its function for the service life of the enclosure; it must be able to withstand a wide range of stresses without deterioration
- Sealability is required for membranes that will be penetrated by screws, nails and other items. If a membrane cannot maintain continuity after being penetrated by fasteners, separate application of sealant to penetrations will be required.
- Ultra-violet resistance and puncture resistance are desirable for membranes that will be exposed to weather and construction activities after they are installed.

AVAILABLE AIR BARRIER MATERIALS

Manufacturers have responded to the need to control air leakage by developing specific air barrier membrane products. Products manufactured for use as air barriers include

- **Self-adhered sheet membranes** are available as air and vapor barriers or vapor-permeable air barriers and typically comply with Code requirements for Water-Resistive Barriers.
- **Fluid-applied membranes** are available as air and vapor barriers or vapor-permeable air barriers and typically comply with Code requirements for Water-Resistive Barriers. They may be formulated for spray application, in which case consideration must be given to the possibility of unwanted overspray. Other products may be applied by roller or trowel.
- **Building wraps** can serve as vapor-permeable air barriers as long as they are structurally supported to withstand both negative and positive wind pressure. They typically comply with Code requirements for Water-Resistive Barriers.

Many construction materials commonly used in exterior enclosures also meet the air permeance and vapor permeance values required of air barriers. Construction materials which may serve multiple functions within the building enclosure may include.

- **Glass mat-faced gypsum sheathing** can serve as an air barrier as well as sheathing if the joints are taped and nail holes and other penetrations are sealed. A separate Water-Resistive Barrier will be required to drain liquid moisture and a separate vapor retarder may be required for some conditions.
- **Plywood and oriented strand board sheathing** can similarly serve as an air barrier if the joints are taped and nail holes and other penetrations are sealed. A separate Water-Resistive Barrier will be required to drain liquid moisture and a separate vapor barrier may be required for some conditions.
- **Closed-cell plastic foam board insulation** can serve as thermal insulation, air and vapor barrier, as well as Water-resistive barrier, if the joints are taped and nail holes and other penetrations are sealed.
- **Closed-cell spray polyurethane foam insulation** can serve as thermal insulation, air and vapor barrier, as well as Water-resistive barrier if installed in strict accordance with manufacturer's recommendations.

The following tables summarize the air and moisture control functions which commonly used construction materials can provide in the building enclosure:

VAPOR PERMEABLE AIR BARRIER MATERIALS

Construction Material	Air Barrier	Water Barrier	Thermal Barrier	Vapor Barrier
Vapor-Permeable, Self-Adhering Sheet Membrane	Yes	Yes	No	No
Vapor-Permeable, Fluid Applied Membrane	Yes	Yes	No	No
Building Wrap, taped and sealed	Yes	Yes	No	No
½" Glass Mat-Faced Gypsum Sheathing, taped and sealed	Yes	No	No	No
Plywood, taped and sealed	Yes	No	No	No
Oriented Strand Board, taped and sealed	Yes	No	No	No

AIR AND VAPOR BARRIER MATERIALS

Construction Material	Air Barrier	Water Barrier	Thermal Barrier	Vapor Barrier
Self-Adhering vapor and air barrier Sheet Membrane	Yes	Yes	No	Yes
Fluid Applied AVB Membrane	Yes	Yes	No	Yes
Board Stock Insulation, taped and sealed	Yes	Yes	Yes	Yes
Spray Foam Insulation	Yes	Yes	Yes	Yes

AIR BARRIER ACCESSORY MATERIALS

Accessory components are critical to air barrier continuity, and include the following:

- Transition strips or tapes required to cover gaps and bridge between different types of construction must be manufactured from materials that are flexible, durable and strong. Elasticity is also required where the material will bridge gaps subject to movement. Transition strips may be self-adhering or may be set in a bed of adhesive or sealant to provide structural support. In either case, the adhesive must be compatible with substrates and appropriate to the temperature conditions to which it will be subjected. Special considerations are needed in making the transition from the opaque wall to fenestration, doors and other openings in the exterior enclosure.
- Sealants play an important role in providing air barrier continuity at penetrations, and can be part of transition assemblies. Sealants are now available that can bridge gaps. Compatibility is critical for proper adhesion of sealants to substrates.
- Fasteners and tapes are required for mechanically attached building wraps and panel materials. Washers are needed at fasteners to prevent tearing of building wraps.

Liquid applied air barrier installation with sheet applied transition membranes at openings. Photo courtesy of Len Anastasi

THINGS TO ADDRESS WHEN EDITING PART 3 – EXECUTION

HOW ARE AIR BARRIERS INSTALLED?

Performance of air barrier assemblies relies heavily on correct installation. Thorough documentation of installation details on the drawings needs to be supplemented with appropriate instructions in the specifications.

SUBSTRATE EXAMINATION AND PREPARATION

Substrate preparation is critical for air barrier materials that rely on a bond with the substrate for structural support.

- For fluid applied products the joints of the sheathing boards must be filled or taped and the mortar joints of masonry units must be filled and cut off flush. Specification of substrate preparation should be included in the specification sections for sheathing and masonry, where these materials will serve as substrates for fluid applied air barrier membranes.
- Self-adhering sheet membrane air barriers require a primer applied to a clean, dry and sound substrate. These membranes can span gaps and cracks in substrates that do not exceed ¼”. Wider gaps, or joints that will experience movement, will require application of surface repair materials appropriate for the given substrate.
- Substrate preparation for spray foam insulations includes providing a clean, dry surface and application of primer on metal surfaces and where recommended by manufacturer.

For mechanically attached air barrier membranes and board stock, substrate preparation consists primarily of providing smooth, secure surfaces to which the materials can be fastened without projections that will tear or penetrate the air barrier.

TRANSITIONS AND PENETRATIONS

Detailing for airtightness at junctions between the main field of the air barrier membrane and adjacent construction is the most challenging part of the air barrier system. These junctions are typically where air leaks are usually found. For a successful air barrier assembly, drawings must identify critical detailing areas and specifications must provide clear instructions on installation. Critical areas for detailing include:

- Roof to wall transitions
- Foundation to wall transitions
- Wall to door transitions
- Wall to window, and wall-to-louver transitions
- Change of substrate transitions
- Soffits and canopies
- Relieving angles
- Building expansion and seismic joints
- Control joints and deflection joints
- Mechanical and electrical penetrations through wall.
- Penetrations of structural and miscellaneous steel through wall

In addition to assuring continuity of the air barrier, detailing at these locations must address lapping for water drainage, potential movement across joints, sequence of installation, coordination with details for other systems, and other concerns. Because the exact approach will depend on which air barrier materials are used, it is important to refer to details prepared by the proposed manufacturer of the air barrier. Consider omitting from the specifications any manufacturer that does not provide such recommendations.

Air barrier installation around openings and projections. Photo courtesy of Len Anastasi

INSTALLATION

Installation requirements and methods for each type of air barrier assembly will depend on the materials that comprise the assembly. Common considerations include:

- Ambient conditions: Membranes that rely on adhesion to a substrate typically have a limited range of temperature and relative humidity at which they can be applied. In some cases, ambient conditions must be controlled for a period of time for proper curing of fluid-applied materials. This type of material must only be applied at those conditions recommended by the manufacturer. Mechanically supported air barriers can often be installed over a wider range of conditions.
- Installation: Installation methods depend heavily on the particular materials that comprise an air barrier assembly. Consult manufacturer's recommendations and require strict adherence to them.
- Protection: Some air barrier materials will degrade when exposed to ultraviolet light, precipitation and temperature extremes. Follow manufacturer's recommendations for covering exposure-sensitive materials with either temporary or permanent weather protection.

Because the exact approach will depend on which air barrier materials are used, it is important to refer to specifications and installation instructions prepared by the proposed manufacturer of the air barrier material. Consider omitting from the specifications any manufacturer that does not provide such recommendations

CONSIDERATIONS FOR EDITING QUALITY REQUIREMENTS IN PARTS 1 AND 3

Because air barrier performance requires coordination of multiple materials and precise installation methods, quality assurance and quality control are critical during the entire construction period. The extent to which such measures are included in specifications will depend on several factors:

- Project size
- Project complexity
- Project budget
- The Owner's goals for the performance of the building enclosure system
- The Owner's requirements that demand precise control of interior conditions
- The engagement of a Building Enclosure Commissioning Provider by the Owner.

A thorough program of quality assurance and quality control is needed for any project which is complex or which must perform according to demanding requirements. Simpler projects will also benefit from as complete a set of the following measures as can be included in the project budget. An Owner's Building Enclosure Commissioning Agent should review drawings and specifications to make sure they include an appropriate level of quality requirements.

QUALITY ASSURANCE

Assuring the quality of an air barrier begins with confirming that the correct materials are used, and that provisions are set up for correct installation.

SUBMITTALS

Submittals for air barrier materials must document the fact that products have been tested as specified and meet specified standards. Certification of testing by an independent laboratory provides the best assurance of a product's performance.

INSTALLER QUALIFICATIONS

Installer qualifications must include both training by the manufacturer of the air barrier material and prior experience in providing successful installations. Installer certification by the manufacturer is available and desirable for many products.

MOCK-UPS

An integrated mock-up of the exterior enclosure is an essential tool for establishing quality standards for installation of an air barrier assembly.

- The mock-up should include a window as well as a range of penetrations and transition conditions. Ideally it will be constructed specifically as a mock-up and retained on-site for reference as a quality standard throughout construction of the building enclosure. On small or simple projects, the mock-up may be a designated area of the permanent enclosure construction. In either case, the scope of the mock-up should be shown on drawings.

- Testing and inspections should be performed on mock-ups in accordance with ASTM E783 and ASTM E1186 to establish the standard of installation that will be accepted.

QUALITY CONTROL

Testing and inspections during construction are an important supplement to quality assurance provisions.

INSPECTIONS

Periodic visual inspection of all components of air barrier assemblies prior to concealment with insulation or cladding should be required and accommodated by the construction schedule. Inspections may be performed by the Building Enclosure Commissioning Provider or other qualified professional retained by the Owner.

AIR BARRIER MATERIAL TESTING

Air barrier materials that are fluid-applied or that rely on adhesion to substrates require the following types of periodic testing of representative areas during construction.

- Adhesion testing of self-adhered membranes, fluid applied membranes, spray foam insulation, as well as sealants and adhesives used.
- Dry film thickness monitoring of fluid applied air barrier materials
- Thickness and density testing of spray foam insulation

Material testing is frequently performed by the installer, but should be documented for review by the Owner and the Owner's consultants.

AIR BARRIER ASSEMBLY TESTING

Qualitative testing is needed to identify locations where the air barrier assembly leaks. The following tests can be done either alone or in conjunction with quantitative testing of air barrier assemblies and whole building air tightness testing.

- ASTM E1186 requires temporary construction of a depressurization chamber on a portion of the building enclosure. A smoke pencil or other means is used to provide visual evidence of air leakage.
- ASTM E1186 also includes protocol for infrared imaging of completed construction in combination with depressurization and pressurization, which is be useful for locating air leaks.

Quantitative testing:

- Testing should be performed on air barrier assemblies at representative locations, in accordance with ASTM E783.

WHOLE BUILDING AIR TIGHTNESS TESTING

Once the building enclosure is complete and the mechanical systems are in operation, the building as a whole can be tested for air tightness in accordance with ASTM E779 or E1827.

- ATSM E779 is a test method for measuring the air leakage of a building using a fan pressurization system, most frequently accomplished with a calibrated blower door fan. Another option is to use the building's HVAC fans, but this is not desirable due to complications.
- ASTM E1827 is a test method for measuring air leakage of a building at a single pressure, using one or multiple calibrated blower door devices.
- Either test can be adapted to measure air leakage of zones of buildings. Because the cost for these tests is high, and increases with increasing building size, the scope of testing should be discussed with the Owner early enough in a project to include them in the project budget.

Because this test is performed late in the construction process, any significant leakage may be very difficult to identify and repair. Whole building testing is best done on a project where air barrier assembly testing and other quality control measures have already been performed as the air barrier is being installed. An appropriate sequence of testing will increase the likelihood that problems will be found at a time when they can be more easily addressed.

NEED HELP?

RESOURCES FOR SELECTING AND SPECIFYING AIR BARRIERS

AIR BARRIER ASSOCIATION OF AMERICA (ABAA)

ABAA-recommended specifications outline a quality assurance program which requires an ABAA accredited sub-contractor with trained and licensed installers. It also requires a complete program of documentation and daily testing by the air barrier sub-contractor, with audits by an ABAA auditor.

- The scope of independent audits of air barrier installations is based on the number of square feet of air barrier installations. The audit reports are sent to the air barrier sub-contractor, the General Contractor and the Architect. If inconsistencies with the drawings, the specifications, or the ABAA quality assurance program are found, the sub-contractor is assessed demerits and the inconsistencies are included in the audit report. If the air barrier sub-contractor receives enough demerits, they lose their accreditation as an ABAA licensed air barrier installer.
- Full time inspection coupled with a random testing protocol would be a better quality assurance program but many projects do not have the funds to do so.

On their web-site http://www.airbarrier.org/, ABAA offers extensive information on air barrier performance and materials.

NATIONAL INSTITUTE OF BUILDING SCIENCE (NIBS)

NIBS maintains the Whole Building Design Guide (WBDG) http://www.wbdg.org/, a comprehensive on-line reference for topics related to the performance of the building enclosure. The WBDG page on air barriers provides an illustrated explanation of the function of air barriers, accompanied by detailed recommendations and examples of applications for preventing air leakage in buildings. Additional references from a wide range of sources are listed.

AUTHORS

LEN ANASTASI, CSI

Len Anastasi worked in the construction industry for twenty years in masonry, waterproofing and restoration work. He currently owns EXO-TEC Manufacturing, Inc. which manufactures specialty construction products, EXO-TEC Solutions, Inc. which performs marketing work for various quality and innovative manufacturers of construction products and EXO-TEC Consulting, Inc. which performs consulting services on building enclosure issues for building owners, managers, design professionals and lawyers. In his construction and consulting work, he has performed inspections and / or repairs on over 300 buildings as well as giving expert testimony in trials and reviews on dozens of legal cases. He is a member of ASTM's E 06 Committee on Building Performance where he has authored both proposed standards as well as proposed changes to existing standards. He is a member of the Boston Society of Architects' Building Enclosure Council where he has presented on several topics and has been sponsored to speak at the Build Boston Exposition, AIA National Convention and CSI National Convention. He has authored several articles and papers on building enclosure performance and has spoken on these topics at several conventions, seminars and meeting. He is a past President of the Air Barrier Association of America and current Director as well as a member of the Construction Specification Institute (CSI) and the International Concrete Repair Institute (ICRI). He is also a guest lecturer at the Boston Architectural Center.

GRETA ECKHARDT, AIA, CSI, CCS

Greta Eckhardt is Senior Specifications Writer at Payette Associates, a research-based architectural design practice in Boston. At Payette, she is responsible for preparation of specifications for major institutional projects, manages the quality review process and contributes regularly to technical resources for the firm. Greta's approach to her work emphasizes technical rigor in product selection and specification, a process to which she brings 30 years of experience as a Registered Architect as well as an advanced background in physical and chemical sciences. A strong advocate for clear and effective means of organizing and communicating construction information, Greta has recently joined the PPDFormat Task Team, a CSI initiative to update format standards for use in early phases of project design. Greta continues as an Alternate member of the MasterSpec Architectural Review Committee following five years of service as a full member. She has been involved for over a decade in the Indoor Air Quality Committee at the Boston Society of Architects and is a current member of the Boston Chapter of CSI and Boston Society of Architects.

BRIAN H. NEELY, AIA, CDT, BECXP, CSI

Brian H. Neely is a Project Manager for the Building Technology Group at Gale Associates, Inc. with over 14 years' experience working on building enclosures. He is currently performing building envelope evaluations for owners and architects as well as working on new designs focused on building repairs, restoration and energy conservation measures. He has experience in developing low-maintenance renovations and energy conservation upgrades to public and private facilities while retaining the historic building elements. Mr. Neely has been actively involved with supplying peer review analysis of designs for new construction projects relating to the building envelope, most recently to educational, research type facilities and medical centers. He is co-chair of the Boston Society of Architect's Building Enclosure Committee and is a past Vice-President of the Northeast Region and past President of the Boston Chapters of the Construction Specification

Institute. Mr. Neely holds a bachelor of architecture from Syracuse University and is a Registered Architect in several U.S. jurisdictions.

PEER REVIEW BY:

WAGDY ANIS, FAIA, CSI

Wagdy Anis is a principal with Wiss, Janney, Elstner Associates, Inc. in Boston. Mr. Anis' professional focus is the integrity and performance of the building enclosure, from a research, design and troubleshooting perspective, as well as high performance, sustainable building design and indoor air quality. He consults regularly to building owners, architects, contractors, product manufacturers and the legal community regarding the design and performance of the building enclosure. He is a founding board member emeritus of the Air Barrier Association of America (ABAA). He serves as a committee member of ASHRAE Technical Committee 4.4, and is the primary researcher on ASHRAE 1478 RP, Testing the Airtightness of Mid and High-Rise Buildings.

Mr. Anis is a board member of NIBS' Building Enclosure Technology and Environment Council and has served as its chair. Mr. Anis is the technical editor of the Journal of Building Enclosure Design issue of the Journal of the National Institute of Building Sciences. As an educator, Mr. Anis has served as professor of building technology in the MArch program at the Massachusetts Institute of Technology and the distance learning MArch program of Boston Architectural College. He lectures extensively on building enclosure design and commissioning the building enclosure. He has authored and co-authored many books, technical papers and articles. He is considered a national resource on air infiltration and moisture control in buildings.

AND SPECIAL THANKS TO:

JAY FORD CSI CCS LEED AP –

We thank Jay for his support as CSI Boston President 2012-2014

MICHELLE ROBERTS, CSI

We thank Michelle for her support as CSI Boston President 2014-2016