FLORIDA BUILDING COMMISSION

"STRONGER CODES THROUGH SCIENCE AND CONSENSUS"

FENESTRATION WATER RESISTANCE WORKGROUP

OPTIONS EVALUATION WORKSHEET

MEETING II—APRIL 16, 2019

This document is available in alternate formats upon request to DBPR, Florida Building Codes and Standards, 2601 Blair Stone Road, Tallahassee, FL 32399, (850) 487-1824.

FENESTRATION WATER RESISTANCE WORKGROUP
OPTIONS EVALUATION WORKSHEET—MEETING II

ACCEPTABILITY RATING EXERCISE OVERVIEW

During the meeting(s) Workgroup members will be asked to review existing proposed options and invited to propose any additional project relevant options for Workgroup consideration. During meetings Workgroup members will be asked to rate the options for acceptability. In addition, following discussion and refinement of options, members may be asked to do additional ratings of proposed options if requested by a Workgroup member. Members should be prepared to offer specific refinements to address their reservations.

Once rated for acceptability, options(s) with a 75% or greater number of 4s and 3s in proportion to 2s and 1s will be considered preliminary consensus recommendations for inclusion in the final package of recommendations.

At any point during the process, any option may be re-evaluated, and rated at the request of any Workgroup member. The status of a rated option will not be final until the final Workgroup meeting, when a vote will be taken on the entire package of consensus ranked recommendations.

The following scale will be utilized for the rating exercises:

ACCEPTABILITY RATING SCALE	*4= Acceptable, I agree*	*3= Acceptable, I agree with **minor reservations***	*2= Not Acceptable, I don't agree unless **major reservations** addressed*	*1= Not Acceptable*

CRITERIA FOR EVALUATING/RANKING PROPOSED OPTIONS		
Effective Options are SMART		
CRITERIA		**EXPLANATION**
S	**SPECIFIC**	It is detailed enough so that anyone reading the *Option* will know what is intended to be accomplished.
M	**MEASURABLE**	The end result can be identified in terms of quantity, quality, acceptable standards, etc. You know you have a measurable *Option* when it states in objective terms the end result or product.
A	**ATTAINABLE**	The *Option* is feasible. Are there resources available, or likely to become available for implementing the *Option*?
R	**RELEVANT**	The *Option* is relevant to the Commission's mission, purpose and charge.
T	**TIME-FRAMED**	There are milestones with a specific date attached to the completion.

KEY ISSUES AND OPTIONS FOF EVALUATION

SCOPE OF WORK

The scope of work for the Workgroup is as follows:

a) Evaluate the Florida Building Code "the Code" requirements relating to design and testing of exterior envelope and fenestration and determine the following:

   1) Whether the Code requirements should be modified to provide better resistance to water intrusion during high wind events, and/or
   2) Whether installation/maintenance of fenestration as well as the installation of the building envelope in general is suspect and should be better defined and more effectively monitored.

b) Formulate a proposed code change language/recommendation for addressing water leakage due to wind-driven rain.

KEY OPTIONS FOR EVALUATION

Options were provided by Joe Belcher, Warner Chang, Jamie Gascon, Mike Guerasio, Gary Hartman, Adam Locke, Jason Seals, Brad Schiffer, Jim Schock, and Steve Strawn. [68 Options]

GENERAL OPTIONS

A.) [Strawn]: Order of priority for this Workgroup should focus on the following:

1) Require the design of the building to incorporate a drainage path for wind driven rain.
2) Require the fenestration installer to provide flashing and sealing details for each unique opening or type of product.
3) Require flashing and sealing plans approval and inspection of process at jobsite.
4) Consider pre-installation mock-up as a training tool as well as well as for use in AAMA 502 for field-testing of newly installed fenestration products.
5) Consider that just as we do to assure long-term durability of our vehicles, long term building durability and function will require fenestration product maintenance.

	SUPPORT LEVEL (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

1. BUILDING ENVELOPE DESIGN (8)

Product Approval and Design Specifications

A.) [Gascon]: All fenestration product approval installation instructions or permit architectural drawings shall fully detail seal joints at the perimeter of openings.
[Coordinate in FBC-B 1403.2 – Weather Protection or FBC-B 107.3.5 – Minimum Plan Review Criteria for Buildings (Commercial section 8 or 11 and Residential section 8 or add section 9).]

	SUPPORT LEVEL (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

B.) [Schock]: Require the design professional to detail fenestration installation requirements on the design drawings. This is not always done to the degree necessary. This should include specifying the sealants and the geometric design requirements.

	SUPPORT LEVEL (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

C.) [Schiffer]: Typical Wall Sections and adjacent finish to window.

	SUPPORT LEVEL (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

D.) [Schiffer]: Typical opening perimeter supporting framework/flashing details.

	SUPPORT LEVEL (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

E.) [Strawn]: This is the number one priority element. Building envelope design includes addressing water management and how wind driven rain will be moved away from the fenestration openings.

	SUPPORT LEVEL (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

Qualifications/Review of Design

F.) [Seals]: Independent review of the design of the envelope.

	SUPPORT LEVEL (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

G.) [Seals]: Qualifications of the designer of the building envelope.

	SUPPORT LEVEL (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

Building Design Document Requirements

H.) [Schock]: Require the design professional to provide installation instructions as part of the design document submittal for commercial construction projects.

	SUPPORT LEVEL (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

2. FENESTRATION DESIGN AND TESTING CRITERIA (9)

Field Testing and Quality Control

A.) [Schock]: Provide for installation water intrusion field-testing for high-rise buildings only.

	SUPPORT LEVEL (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

B.) [Seals]: Physical testing of a mockup of the envelope before construction commences, and quality control testing during the construction process.

	SUPPORT LEVEL (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

Manufacturer's Testing/Design

C.) [Schock]: Provide for manufactures testing of custom window designs and curtain wall assemblies for water intrusion for high-rise construction only.

	SUPPORT LEVEL (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

D.) [Schiffer]: Typical movement of water within window assembly.

	SUPPORT LEVEL (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

Evaluation of Current Code/Standards/Testing Requirements

E.) [Locke]: Review existing design and testing requirements for water resistance of fenestrations, discuss potential FBC constraints on alteration of fenestration designs related to potential leakage resistance requirement changes, and evaluate the influence of alterations on construction. Determine whether reasonable means are available to increase water resistance of fenestrations. Provide recommendations for alterations of current codes and standards regarding fenestration design and testing.

	SUPPORT LEVEL (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

F.) [Guerasio]: Develop a standard that will test the entire assembly installed and not just the unit itself.

	SUPPORT LEVEL (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

G.) [Belcher]: Evaluate the design pressure used in the wind driven rain testing. What is the genesis of the current 15% and 20% specified?

	SUPPORT LEVEL (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

H.) [Belcher]: Evaluate AAMA 520. 1. What wind speed equates to the various pressures given in AAMA 520? 2. Why is AAMA 520 not considered suitable for adoption by the fenestration industry? 3. What is the cost associated with testing to the higher design pressures cited in AAMA 520?

	SUPPORT LEVEL (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

I.) [Strawn]: Fenestration products are designed to perform a variety of roles to meet the building codes in the most cost effective way and also meet the building owner's expectations of functionality. Products are tested to the latest standards to ensure they meet the design wind load requirements for the application as well as meeting air and water infiltration testing requirements under specified loads based on code adoption of industry standards. Additionally, the products must be easy to operate with prescribed maximum forces to initiate and maintain motion to a fully open position. Products must be able to provide an accessible path which could be blocked with threshold extensions or even reduction of a net clear opening on an egress sized window. Design and testing criteria changes may add additional cost to the consumers and not really improve performance if a poor installation or lack of proper maintenance is continued to be allowed.

	SUPPORT LEVEL (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

3. INSTALLATION INSTRUCTIONS (PRODUCT APPROVAL & CODE REQUIREMENTS) (14)

Evaluate Installation Instructions

A.) [Locke]: Review the current requirements for window installation; including, FBC requirements, requirements for product approval testing and details, and the recommendations of FBC referenced standards. Determine the adequacy of the requirements for installation instruction creation and codification of water resistance. Provide recommendations to ensure consistency of information that is required to be provided within installation standards and specifications.

	SUPPORT LEVEL (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

B.) [Schiffer]: Flashing methods as part of Installation Instructions.

	SUPPORT LEVEL (%)	*4— Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

Evaluate Product Approval Submittal Requirements

C.) [Schiffer]: Flashing methods as part of Product Approval.

	SUPPORT LEVEL (%)	*4— Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

D.) [Guerasio]: Provide more specific information within the installation details for water proofing in product approvals and the specific products to be used including the installation requirements. Show installation of such items as air and water pads which are currently not shown in most installation details.

	SUPPORT LEVEL (%)	*4— Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

E.) [Chang]: FBC or NOA should cover product installation. I think flashing around the opening may not have good reference if no details on approved plans. Workgroup need to clarify what information is lacking in permit documents.

	SUPPORT LEVEL (%)	*4— Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

F.) [Strawn]: This is the number two priority. Along with envelope design, the next element is the correct selection of and incorporation of the components and materials into the envelope. For fenestration products that includes a detailed flashing and sealing method specific to the building design. Product approval can include the two key fenestration installation methods, either surface barrier or drainage plane, but depending on the specific building design may also need site specific detailing on proper flashing and sealing of the fenestration into the opening.

	SUPPORT LEVEL (%)	*4— Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

G.) [Seals]: Feasibility of including waterproofing details in the fenestration product approval documents.

	SUPPORT LEVEL (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

Code/Standards Requirements and Changes

H.) [Guerasio]: Reinstate codes that have been taken out throughout the years during the code development process which enforced water-stop methods. Example:

1. 2010 FBC 1820.3.4 All slab edges require a minimum of ¾" recess supporting exterior walls.
2. 2014 FBC 1710.10 Buck considered as substrate.
3. When a chapter in the code provides an exception in the beginning of it for HVHZ sections, provide a blanket statement also that if the specific is not addressed within the HVHZ sections, that the rest of the chapter can be used regardless of the location of the reference within that chapter.

	SUPPORT LEVEL (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

I.) [Chang]: Requiring caulk/silicon on all glazing panel to frame support in addition to gasket for Threshold buildings located in Exposure D.

	SUPPORT LEVEL (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

J.) [Chang]: Add code language to limit deflection, consider glazing category in Table 1604.3. This is especially critical for larger openings such as storefront system from ceiling to floor. Excessive separation or looseness between glazing panel and support frame @ mid-span will promote undesirable wind-driven water penetration.

	SUPPORT LEVEL (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

K.) [Chang]: IF installation and maintenance are not the issues here. Workgroup can consider adopting the FMA/AAMA 200 for threshold buildings in Exposure D.

	SUPPORT LEVEL (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

L.) [Guerasio]: Code sections must be reviewed, and the current wording adjusted to help municipalities to enforce these minimum code standards. Today's world has become a play on words and is being used to deflect the minimum requirements.

	SUPPORT LEVEL (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

M.) [Chang]: Typically, the mid-rise and high-rise structures would be considered as Threshold-type buildings. Incorporate similar language for installation, inspection, & recertification similar to FBC SECTION 2415 for all Exposure D.

	SUPPORT LEVEL (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

N.) [Guerasio]: Design something as simple as an ¼" or so integral flange in the window jamb extrusion that will fit into the window sash when in the closed position that will prohibit water from entering and act as a dam.

	SUPPORT LEVEL (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

4. PLANS REVIEW AND INSPECTIONS OF INSTALLATIONS (6)

Design Document Requirements

A.) [Schiffer]: Construction Documents Detailing of flashing.

	SUPPORT LEVEL (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

Inspection Requirements

B.) [Schock]: On high rise construction require a pre-installation inspection meeting with the design professional and contractor to review a mock up and installation instructions prior to moving ahead with installation.

	SUPPORT LEVEL (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

C.) [Schiffer]: At what Construction Stages to field test.

	SUPPORT LEVEL (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

D.) [Seals]: Requirements for physical testing of a mockup of the envelope before construction commences, and quality control testing during the construction process.

	SUPPORT LEVEL (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

Plans Review/Inspection Requirements

E.) [Strawn]: In sequential order, this step is number 3 in priority. Plans review to affirm correct selection of components and materials for the design loads of the building, then inspections to ensure the products are installed in accordance with the approved installation instructions is without question a critical component of the process.

	SUPPORT LEVEL (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					

Comments:

F.) [Belcher]: Determine the typical level of required training related to fenestration for plan reviewers and inspectors.

	SUPPORT LEVEL (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

5. EDUCATION, TRAINING, AND MAINTENANCE (13)

Plans Reviewers, Inspectors, and Installers Training and Education

A.) [Strawn]: Fenestration installation education and training is really the role of the building design team and the owner working with the fenestration installation contractor in terms of design of installation and construction of a mock-up whether as a stand-alone mock-up or installed in the building as a training tool for the builder/installer to understand the process or to the installation performance using AAMA 502 for example.

	SUPPORT LEVEL (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

B.) [Belcher]: Evaluate existing available training for plan reviewers, inspectors, and installers.

	SUPPORT LEVEL (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

C.) [Belcher]: Explore developing training for plan reviewers, inspectors, and installers.

	SUPPORT LEVEL (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

D.) [Belcher]: Determine the level of required training for installers.

	SUPPORT LEVEL (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

E.) [Guerasio]: AAMA or such require that a minimum of at least one individual within an installation crew must possess a certification (same as Polyfoam requires for the installation of their products) which has completed an educational training course for the proper installation of fenestrations. This certification would have to be renew by completing an additional training course every two years and would be specific to the products being installed (windows or doors, etc. same as Polyfoam).

	SUPPORT LEVEL (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

Consumer Education and Maintenance Requirements

F.) [Schock]: Require operation and maintenance manuals be delivered to the owner at turn over.

	SUPPORT LEVEL (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

G.) [Guerasio]: Develop a program to educate the public that consists of brochures, informational links on state website and even television series which will provide information on what to do to your existing openings to minimize the risk of water damage during an event. How to maintain the openings throughout the year and inspect for any damage, etc.

	SUPPORT LEVEL (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

H.) [Guerasio]: Are fenestrations manufactured specifically for both HVHZ and non-HVHZ, provide this information to the municipalities and consumers.

	SUPPORT LEVEL (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

I.) [Belcher]: Explore developing an outreach program targeted at making consumers aware of and instructing Consumers on the proper maintenance of sealing.

	SUPPORT LEVEL (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

Education Strategies and Requirements for Design, Installation, Inspection, and Maintenance

J.) [Locke]: Evaluate the creation of plain language pamphlets and/or checklists for the purposes of education and training of designers, contractors, building inspectors and the general public regarding fenestration installation, performance expectations, and maintenance.

	SUPPORT LEVEL (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

K.) [Chang]: FS CHAPTER 489 CONTRACTING governs licensing, continuing education, certification. Adding language in FBC would be repetitive.

	SUPPORT LEVEL (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

L.) [Chang]: Good idea for maintenance, **FBC SECTION 2415.7.4** can be implemented for buildings in Exposure D for threshold buildings.

	SUPPORT LEVEL (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

M.) [Strawn]: Maintenance of fenestration products is generally a building maintenance issue out of the hands of most fenestration manufacturers. Maintenance such as cleaning fenestration elements beyond just glass, adjusting or replacement of worn weatherstrips, and adjustment of hardware such as sliding door rollers or locks, inspection of all exposed fasteners for corrosion, as well as maintaining the sealants at critical interfaces must be a part of the building maintenance plan to ensure proper long term function of the fenestration products in the wall opening.

	SUPPORT LEVEL (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

6. FURTHER INVESTIGATIONS AND ADDITIONAL TESTING NEEDS (13)

Sources/Causes of Water Intrusion

A.) [Schock]: In general water intrusion should be addressed with an additional workgroup reviewing and evaluating the latest FEMA MAT reports and recommendations to include information from Hurricane Michael, Irma, and Mathew.

	SUPPORT LEVEL (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

B.) [Schiffer]: Sources of water entry: Within perimeter supporting framework. At flashing: Within window assembly.

	SUPPORT LEVEL (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

C.) [Schiffer]: Locations of water entry, Sill, Jamb or Head.

	SUPPORT LEVEL (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

D.) [Chang]: Workgroup needs to hunker down and find the cause(s) of these water intrusion issue before starting to make changes to codes/standards. It does not make sense to make the Code more stringent if the water intrusion is caused by improper installation or caulk shrinking, which are tied to verification and maintenance in respective.

	SUPPORT LEVEL (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

E.) [Seals]: After his post-storm investigations Mr. Lavrich concluded that "Significant water intrusion through the exterior envelope took place in extraordinary amounts in all of the buildings inspected," and "Although the condition of the fenestrations varied greatly due to age, the water resistant to high wind was similarly deficient in every case." While Mr. Lavrich's expert credentials are well established there should be an independent review of the data to validate these conclusions. The review should include:

- History of the buildings evaluated:
  - What is the maintenance history of the buildings?
  - How often are the fenestrations inspected and cleaned?
  - How often are the exterior perimeter inspected and maintained?
- Details about the fenestration systems:
  - What was the design pressure of the building?
  - What were the tested ratings of the fenestrations?
  - How did the tested ratings compare with the winds speeds and rainfall amounts generated by the storm?
  - What percentage of the products were manufactured under the oversight of an accredited certification program or approved product quality assurance program?
  - Were the fenestration products installed per the manufacturer's approved installation details and/or product approvals?
- The methods used to evaluate the interior and exterior of the building envelope
  - Were there any inspections of the exterior of the building envelope?
  - Was there any forensic testing of the wall or fenestration systems?
  - What processes were used to eliminate issues with the surrounding walls?
- How it was determined the "water resistance (of the fenestration) to high wind was similarly deficient in every case."
- What was the response of the fenestration manufacturers when contacted about leakage through the fenestration? Was any remedial work performed?
- What percentage of the water penetration was attributable to leakage through the fenestration, leakage around the fenestration, and leakage through the surrounding wall?
  - Regarding the water that leaked through the fenestration product, what percentage of the water penetration could be attributed to design of the product, defects in workmanship in the assembly of the product, and products that were not rated high enough for water penetration resistance?
  - Regarding leakage attributed to the interface between the building and the fenestration, what percentage of the leakage was attributed to workmanship vs. failed materials vs. the design of the waterproofing methods?

	SUPPORT LEVEL (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

Determine Causes of Water Intrusion/Investigations/Testing

F.) [Belcher]: Examine the greatest area of leakage. Sliding glass doors versus windows. 2.) what was point of leakage? Threshold? Jambs? Through windows? Through doors?

	SUPPORT LEVEL (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

G.) [Belcher]: Was leakage due to poor design, poor installation, poor maintenance? Would higher design pressure for water intrusion test impact outcome?

	SUPPORT LEVEL (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

H.) [Belcher]: Were the increased thresholds of the FBC-EC FHAG Requirement 4 Paragraph (5) used where sliding glass doors were found leaking.

FBC-A FHAG

Requirement 4 - Accessible route into and through the covered dwelling unit.

(4) Except as provided in Paragraphs (5) and (6) below, thresholds at exterior doors, including sliding door tracks, are no higher than 3/4 inch. Thresholds and changes in level at these locations are beveled with a slope no greater than 1:2.

(5) Exterior deck, patio, or balcony surfaces are no more than 1/2 inch below the floor level of the interior of the dwelling unit, **unless** they are constructed of impervious material such as concrete, brick or flagstone. In such case the surface is no more than 4 inches below the floor level of the interior of the dwelling unit, or lower if required by local building code.

	SUPPORT LEVEL (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

Testing Facilities Inspection

I.) [Guerasio]: Develop a stringent inspection program of the testing facilities themselves to ensure that the minimum standards are being enforced and tested correctly.

	SUPPORT LEVEL (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

Field Investigations

J.) [Hartman]: Perform additional field investigations of properties affected by Hurricanes Irma and Michael to develop a more rigorous description of the problem, including leakage paths and contributing factors.

Discussion: My own experience with post disaster damage assessments following Hurricane Irma supports Mr. Lavrich's observations of water infiltration through apparently undamaged fenestration. However, none of the evidence I've seen to-date rises to the level of systematically identifying leakage paths and contributing factors. This information is essential for developing relevant and effective options. Perhaps this such data will be collected in Dr. Prevatt's "Study of Water Resistance Performance of Exterior Envelope Relating to Fenestration During Minimal High Winds" or could be added to that scope?

	SUPPORT LEVEL (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

K.) [Strawn]: In cases where significant risk to the building owner is expected it may be considered that commission testing of the installed product is warranted. This is a follow-up to Education and Training as noted above.

	SUPPORT LEVEL (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

Testing

L.) [Schiffer]: Examples of tests with increasing pressures.

	SUPPORT LEVEL (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					

M.) [Hartman]: Perform a literature review of comparisons of static, cyclic static, and dynamic testing methodologies similar to that presented in Lopez's thesis, *Comparison of Wind-Driven Rain Test Methods for Residential Fenestration* (attached).

Discussion: Lopez's research would seem to indicate that different testing methodologies are effective at exposing different leakage paths. Static methods exposed more sealant and interface issues and dynamic tests exposed issues within the fenestration products themselves. As we learn more about the leakage paths and contributing factors to water intrusion during recent hurricanes, this information will help us to identify testing options most effective at identifying these paths.

	SUPPORT LEVEL (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
April 2019 Rating					
Comments:					