MARVIN Windows and Doors
Built around you.®

UNDERSTANDING SPECIFICATIONS

FOR CLAD WOOD AND FIBERGLASS WINDOWS

LEARNING OBJECTIVES

At the end of this program, participants will be able to:

1. Review the need for clear specifications, as well as the different types and formats.
2. Explain how to fill out Division 08 CSI specifications in a careful and well-ordered way for both residential and commercial projects.
3. Describe the importance of referencing codes, industry standards and performance requirements in window specifications.
4. Understand how to write clear and concise specifications utilizing the resources of manufacturer's representatives to clearly convey the design and performance intent of the drawings.

WELL WRITTEN WINDOW SPECIFICATIONS

Windows represent quite a large component of a project's budget, ranging from five to ten percent or more. Therefore, window specifications that are not clear and concise could create wide price and performance variations, resulting in significant cost and time delays once the project commences. Specifications help to maintain both the material and labor budget for a project, avoid project delays, and set expectations regarding the aesthetics and performance of the finished building product.

Construction documents define the rights of, responsibilities of, and relationships among the parties. Standard contracts, drawings and specifications have been published by several professional organizations so that information can be placed in a predetermined location for each construction project, which provides familiarity through repeated use, resulting in clear and well-coordinated documents. Specifications are more easily coordinated with the drawings, specification sections can be coordinated with each other, and A/E consultants can correctly integrate their work with less effort and error.

Specifications complement, but should not repeat, information shown on the drawings. Nor should the drawings duplicate information contained in the specifications. Properly prepared drawings and specifications should dovetail like a jigsaw puzzle, without overlaps or gaps.

If a requirement on the drawings or in the specifications is duplicated in the other, an opportunity arises for a discrepancy between the two. An addendum covering a design change may correct the item in one location but overlook it in the other. Last-minute changes are most likely to create discrepancies of this sort. Such discrepancies may cause bidders to make different interpretations of what is required, often resulting in change orders and extra costs.

CONSTRUCTION SPECIFICATIONS INSTITUTE

The Construction Specifications Institute (CSI) is an organization that keeps and changes the standardization of construction language as it pertains to building specifications. CSI provides structured guidelines for specification writing in their Project Resource Manual.

Window specifications that are not clear and concise could create wide price, performance and quality variations, resulting in significant cost and time delays once the project commences.

CSI-authored MasterFormat is an indexing system for organizing construction data, particularly construction specifications. MasterFormat is the most widely used standard for organizing specifications and other written information for commercial and institutional building projects in the U.S. and Canada. It provides a master list of divisions, and section numbers and titles within each division, to follow in organizing information about a facility's construction requirements and associated activities. Standardizing the presentation of this information improves communication among all parties involved in construction projects.

For many years MasterFormat consisted of 16 Divisions of construction, such as Masonry, Electrical, Finishes or Mechanical. In November 2004, MasterFormat was expanded to 50 Divisions, reflecting the growing complexity of the construction industry, as well as the need to incorporate facility life cycle and maintenance information into the building knowledge base. The Division we will be discussing today is Division 08–Windows and Doors.

CSI specifications use a 3-part 'SectionFormat' standard for organizing information in each section–Part 1-General, Part 2-Products and Part 3-Execution. Each Part is further organized into a system of Articles and Paragraphs.

PART 1-GENERAL

Part 1 includes general information such as a summary of the specification sections and an overview of what should be covered at pre-installation meetings.

This section should also specify how action submittals such as product data, LEED submittals, shop drawings and samples or mock-ups should be delivered, as well as informational submittals such as warranties.

Part 1 also covers quality assurance of the manufacturer and installer, delivery, storage and handling considerations, as well as details about the manufacturer's warranty.

REFERENCE STANDARDS

Another very important section of Part 1 calls out reference standards that should be followed such as those of the American Society for Testing and Materials (ASTM), American Architectural Manufacturers Association

Part 1 calls out reference standards that should be followed such as those of ASTM, AAMA and NFRC, as well as a description of the specific minimum window performance ratings that are required.

(AAMA) and the National Fenestration Rating Council (NFRC), as well as a description of the specific minimum window performance ratings required for the project. These may include performance class and grade, thermal transmittance, solar heat gain coefficient, U-factor, visible transmittance, air infiltration, water infiltration and impact resistance among many others.

In addition, if the project is located within a very specific area such as a high velocity hurricane zone that requires attention to local building code product rating information, such criteria should be included here as well.

MANUFACTURERS

A common mistake with specification writers is drafting a specification around a particular manufacturer only to list other 'acceptable or equal' manufacturers without careful research to identify their ability to perform or comply. The specification writer should identify the manufacturer as 'basis of design' and invite other manufacturers to submit prior to bid through the Substitution process outlined in Division One – General Conditions. Approvals of substitutions would then be issued by addendum.

Another consideration for the manufacturer section of the specifications is that the retailer pricing the windows could be unaware of the location or exposure of a project, requiring additional attention in the specifications to performance ratings or installation requirements such as wind borne debris protection, impact glazing, design pressure considerations or mull reinforcement.

DESIGN PRESSURE CONSIDERATIONS

Note that for every project it is necessary for an engineer, certified in the state where the project is being constructed, to develop Design Pressure (DP) requirements. Design Pressure is the measurement of the amount of wind pressure that a window or door is designed to withstand when closed and locked expressed in lb/ft^2. DP ratings include both positive and negative numbers.

The positive number corresponds to pressure created by wind blowing at the exterior of a window, and the negative number represents vacuum pressure on the interior side of the product. DP rating requirements are site specific. They vary according to product location on the building, height of the building, density of buildings and wind speed. It is the architect's responsibility, if they don't have an engineer on staff, to hire one to develop DP requirements.

ROUGH/MASONRY OPENINGS

When specifying windows it is very important to take into consideration both rough and masonry openings. A rough opening (RO) is the opening left in a frame wall to receive a window unit. The studs on each side, which support the header across the top and the sill at the bottom, form the rough opening. The rough opening generally allows approximately 1/2" at each jamb and at the head of the window frame to allow for installation. Also, sill pans can affect the height of the rough opening.

When specifying windows it is very important to take into consideration both rough and masonry openings.

That being said, the determination of rough opening dimensions is relative to the fenestration frame size and varies by manufacturer and product frame material. There is no industry standard for this clearance and even products within the same brand vary in perimeter clearance.

Openings in brick walls are known as masonry openings (MO). Masonry openings incorporate frame width on all four sides of the window frame in conjunction with an additional sealant joint (1/4" to 3/8" typically).

The specifier should provide enough information with details or a written description so the contractor can figure out what the rough opening or masonry opening should be. The addition of special casings and sills affect the masonry opening and should be articulated, as they will determine the actual frame/rough opening of the window.

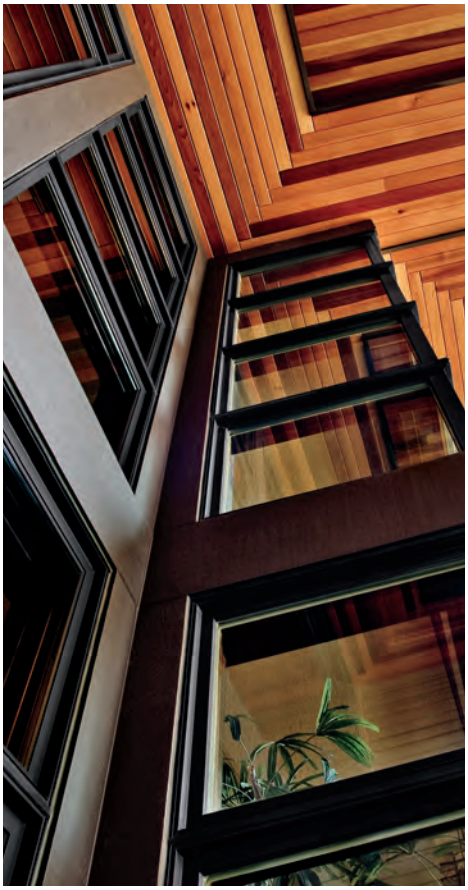
Applied window elements such as casings and sills are available in a multitude of widths and profiles, which could greatly affect the rough or masonry opening size. If showing a window with casing on it, the dimensions of this casing should be specified.

Delineating sizing on drawings by manufacturer model or call numbers eliminates confusion. The size of each individual window element can have a significant cost impact on a large project. Be sure to indicate tolerances allowed for sizes specified for custom vs standard manufacturer sizes.

PART 2-PRODUCTS

The specifications will then move into descriptions of the specific elements of the windows, from frames and sashes to glazing, finish, hardware, insect screens and accessories.

In general, call numbers and approximate sizes are best shown in the drawings, not in the specifications.



The frame description should include the window style and shape, both interior and exterior finishes, basic dimensions such as the thickness and depth of the frame, and the use of certified wood, if required.

The frame description should include the window style and shape, both interior and exterior finishes, basic dimensions such as the thickness and depth of the frame, and the use of certified wood, if required. Specifications will articulate casing width and thickness, sill horn length, sill thickness and extensions, the use of elements such as aprons, back bands, drip caps and cove molding, as well as whether the casing should be field applied or factory applied.

Casing and sill accessories should be specified for material (i.e extruded aluminum) and finishes to match the window. However, profiles and dimensions are best illustrated on the drawings.

SASH

The sash description will include the operating type such as double-hung, casement, awning, radius or fixed, interior and exterior finishes, the thickness and type of mullions, mulling configurations and anchoring requirements. Divider options, profiles and spacers bars will also be covered.

MATERIALS

Material choices, as well as exterior and interior finishes, have increased in offerings and complexity. Wood windows are available in differing species, and may come pre-finished, primed, stained or have field-applied finish options. Other options besides wood are aluminum clad wood, fiberglass composites and vinyl. There are also special hybrid options such as aluminum clad windows with PVC surrounds, or an aluminum clad sash with a wood frame. The materials section will specify the primary and cladding materials.

FINISHES

Finish specifications will often note that the finish meet a certain AAMA standard. AAMA has a set of test criteria and specifications designed to determine the minimum level of performance for finishes available on extruded aluminum clad windows (for example). The three specifications range from good to better to best level of performance: 2603, 2604 and 2605. The finish section will also specify the desired color and interior finish options. A finish must be durable and low maintenance, providing resistance to scratching and marring as well as fading and chalking.

Interior / Exterior finishes not provided by the manufacturer should be specified in their own specification section 'Finishes'. Window specifications should 'Reference' other specification sections relative to the windows. Example: Window interior wood surface shall be factory primed ready for site finishing. See spec section _____.

HARDWARE

The hardware section of the specifications will specify the balance system (if hung windows), the jamb carrier material and color, as well as lock and latch material and finish. If referencing an awning or casement window, hinges and crank handles will be specified.

Hardware can range dramatically in price and standard options are not necessarily the same price. There is a big price difference between standard architectural hardware and performance hardware such as physical vapor disposition (PVD) or stainless steel, which are often used in coastal applications due to the corrosive nature of the environment. Any custom hardware will require modifications and additional cost.

GLAZING

Glazing specifications may include the number of panes, the glazing method, type of glazing seal, the type of filler, and glass type including specialty glass such as Low E, insulating glass, safety glass, impact glass for coastal installations, or historic considerations. Performance requirements in this section should comply with code to promote energy savings, improved comfort, reduced fading, less condensation and increased light and views. Performance requirements specified here may include impact resistance, UV transmission, sound transmission class (STC) and outdoor/indoor transmission class (OITC).

Glazing specifications may include the number of panes, the glazing method, type of glazing seal, the type of filler and glass type.

Any special installation considerations based on unique aspects of a project should be specified in the Installation section.

ACCESSORIES

Windows have several accessories that must be specified such as insect screens and grilles. When insect screens are used, specifications should indicate operable vs. fixed units. Types of operable insect screens may include swinging or retractable screens. The specifications should indicate the screen mesh size and material, the frame material, and finish color.

Specify the quantity and type of grilles, which may include simulated divided lites (SDL), authentic or true divided lites (ADL or TDL), grilles between glass (GBG), snap-in grilles, lead caming or internal spacer bars. The widths, profiles, finish and color, interior and exterior material, and pattern will all need to be specified. Divider options should be specified and illustrated in section on the drawings.

FABRICATION

Part 2 may also include a section on fabrication, generally specifying that the majority of components should be fabricated in the factory to the greatest extent possible, allowing for scribing, trimming and fitting at the project site.

PART 3-EXECUTION

EXAMINATION

The examination section of the specifications denotes that all window components should be examined before installation with the installer present. Openings, substrates, structural support and anchoring should be examined, and rough opening dimensions, sill levelness and operational clearances should be verified. Wall flashings, vapor retarders, water and weather barriers and other components should be examined to promote a weathertight window installation. Any defects or unsuitable conditions should be reported to the general contractor before proceeding.

INSTALLATION

The installation section of the specifications typically has general notes to comply with the manufacturer's written instructions for installing windows, hardware, accessories and other components and to reference shop drawings. There should be instructions to install windows level, plumb, square, true to line, without distortion, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction. Any special installation considerations based on unique aspects of a project should be specified here.

CLEANING

This section should cover removing visible labels and leaving the interior and exterior of windows and glass in clean condition. Specify to remove excess sealants, glazing materials, dirt and other substances and keep protective films and coverings in place until the final cleaning.

The section should also address construction substances such as chemicals, solvents and paint that may damage window surfaces and measures to protect them. Follow manufacturer's cleaning instructions and warranty information.

WINDOW SCHEDULES

Schedules help simplify communication by presenting data in a tabular form or in a matrix. The location and content of schedules may vary widely among A/Es. When placed in a specification section, schedules are included at the end of Part 3. Although not technically part of execution, the schedules are placed there for convenience in specification preparation, although they can be included in the specifications or on the drawings.

A common example is a window schedule. Schedules that include materials from multiple specification sections should be included in the drawings rather than the specification. When a single type of window is utilized on a project, the specifier may elect to delete the schedule in its entirety. When schedules are included on the drawings, the schedule should be deleted from the specification to avoid redundancy.

REFERENCING CODES, INDUSTRY STANDARDS AND PERFORMANCE REQUIREMENTS

As we've already discussed several times throughout this article, writing specifications so that installed windows meet building codes, industry standards and performance rating requirements is of utmost importance.

The International Code Council is an association that develops model codes and standards used in the design, build and compliance process to construct safe, sustainable, affordable and resilient structures. The International Codes, or I-Codes, published by ICC, provide minimum safeguards for people at home, at school and in the workplace. The I-Codes are a complete set of comprehensive, coordinated building safety and fire prevention codes.

The purpose of building codes is to provide minimum standards for safety, health and general welfare including structural integrity, mechanical integrity, means of egress, fire prevention and control, and energy conservation. They support the industry's need for one set of codes without regional limitations, although there may be local codes that will override those of the ICC; local codes will generally be stricter. The ICC codes we will reference here are the International Building Code (IBC), International Residential Code (IRC) and International Energy Conservation Code (IECC).

The IBC references fenestration in regards to design loads, impact resistance, energy requirements, minimum sill height, installation, safety glazing and egress rules, among others.

Exterior windows and doors are covered in Section 1710.5 of the 2012 IBC and Section R612 of the 2012 IRC. These sections require windows and sliding doors to be tested and labeled in accordance with AAMA/WDMA/CSA 101/I.S.2/A440-11, a standard developed jointly by the American Architectural Manufacturers Association, the Window & Door Manufacturers Association and the Canadian Standards Association.

EGRESS WINDOW

An egress window is a window that is required in specific locations in a dwelling and is intended to provide an emergency means of exiting a dwelling. Egress windows are required in every room used for sleeping purposes (bedrooms) and on any floor and in basements with habitable space.

If you are constructing a new home, the code requires that you put an egress window in each bedroom. It also requires an egress window in the basement if habitable rooms will be finished in the basement. If you install a basement bedroom or bedrooms, an egress window is required in each bedroom. If you have an existing home and you add a sleeping room in an unfinished basement, the code requires that you install an egress window in the sleeping room or rooms.

Typically, the size requirements for an egress window are that the window must have a minimum net clear opening of 5.7 square feet (5.0 for ground floor). The minimum width of the opening must be 20 inches and the minimum height 24 inches. You might assume that a 20 inch by 24 inch window would be acceptable for egress. However, those dimensions would yield a net clear opening of only 3.3 square feet. To achieve the required net clear opening of 5.7 square feet, a 20 inch wide window would have to be 42 inches high. Likewise, a 24 inch high window would have to be 34 inches wide.

Net clear opening refers to the actual free and clear space that exists when the window is open. It is not the rough opening size or the glass panel size, but the actual opening a person can crawl through.

The window opening must be operational from the inside without keys or tools. Bars, grilles and grates may be installed over windows but must be operational without tools or keys and still allow the minimum clear opening.

INDUSTRY TESTING AND PERFORMANCE STANDARDS

Beyond building codes, performance rating standards will often be referenced in specifications. Besides protecting against product failure, familiarity with industry standards allows architects more freedom in their designs because they can minimize over-designed and under-designed product selection, determine appropriate products to best fit specific project needs, and control project costs with correct products.

An egress window is a window that is required in specific locations in a dwelling and is intended to provide an emergency means of exiting a dwelling.

The Integrated Performance Standard is a result of the merging of several AAMA, WDMA and CSA standards; it was developed to reduce confusion in the industry due to inconsistent rating and testing procedures.

Testing and performance of the total product is emphasized, and can include structural wind pressure resistance, water penetration resistance, air infiltration, structural deflection, solar heat gain coefficient (SHGC), sound transmission class (STC), visible light transmittance (VT), forced entry and operating force, among others.

INTEGRATED PERFORMANCE STANDARDS

The Integrated Performance Standard is a result of the merging of several AAMA, WDMA and CSA standards. It was developed to reduce confusion in the industry due to inconsistent rating and testing procedures. This combining of standards gives specifiers one single document for comparing products of all material types. The integrated standards target the performance ratings of windows and doors.

Versions of the window and door standards provide uniform performance criteria for testing and certification to the window and door industry. This standard establishes minimum requirements for aluminum, vinyl (PVC) and wood windows.

Testing to these specifications is voluntary, and implies that a manufacturer wants to bring you quality products and is willing to have them independently tested to meet specific performance rating criteria. The WDMA Hallmark Certification labels add specification verification through plant inspections.

The AAMA/WDMA/CSA 101/I.S.2/A440-11 Specifications for Windows, Doors and Skylights identifies requirements for windows, glass doors, skylights and side-hinged exterior doors. Structural integrity, water resistance, air leakage and forced entry are among the performance requirements addressed. Window and door products are divided into 4 Performance Classes for rating purposes (R, LC, CW and AW).

AMERICAN SOCIETY OF TESTING AND MATERIALS

Besides integrated performance standards, individual organizations still have their own standards for fenestration products. For example, these are a few ASTM standards that may be seen in CSI specifications:

- E283: Standard Test Method for Rate of Air Leakage through Exterior Windows, Curtain Walls and Doors
- E330: Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference
- E547: Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls and Doors by Cyclic Static Air Pressure Differential
- E 1996: Standard Test method for Impact Glazing

AAMA

AAMA provides manufacturers with the means to independently demonstrate product performance to their customers via the AAMA Certification. Example AAMA certifications include:

- AAMA 450-10, Voluntary Performance Rating Method for Mulled Assemblies

AAMA 450 describes the procedures and requirements for determining air infiltration, water resistance, and structural performance of mulled products that are either factory built or field assembled. It also provides test or calculation procedures for determining the structural performance of mulled products.

The following group of specifications describes test procedures and performance requirements for organic coatings applied to aluminum extrusions and panels. All three standards also include an Appendix which describes differences in test procedures and performance requirements for organic coatings, applied on a coil coating line to aluminum architectural products:

- AAMA 2605-13, Superior Performance Organic Coatings on Aluminum Extrusions and Panels
- AAMA 2604-13, High Performance Organic Coatings on Aluminum Extrusions and Panels
- AAMA 2603-13, Pigmented Organic Coatings on Aluminum Extrusions and Panels

Finally, this group of specifications describes performance requirements and test procedures for organic coatings on fiber reinforced thermoset profiles:

The Window and Door Manufacturer's Association (WDMA) creates finished product standards to encourage the production of higher quality, more energy-efficient products with a clear value and certifiable performance advantage.

- AAMA 625-10, Superior Performance Organic Coatings on Fiber Reinforced Thermoset Profiles
- AAMA 624-10, High Performance Organic Coatings on Fiber Reinforced Thermoset Profiles
- AAMA 623-10, Organic Coatings on Fiber Reinforced Thermoset Profiles

WINDOW AND DOOR MANUFACTURER'S ASSOCIATION

The Window and Door Manufacturer's Association (WDMA) creates finished product standards to encourage the production of higher quality, more energy-efficient products with a clear value and certifiable performance advantage.

The WDMA Hallmark Certification Program is a third party certification program that manufacturers and suppliers of windows, doors and skylights voluntarily participate in for added credibility. The program consists of a series of inspections and tests to determine that products are being manufactured in the same way as the sample products upon which certification testing was performed.

The Hallmark Program offers straight forward effective means for code officials, builders, architects, specifiers and consumers to identify products that have been manufactured in accordance with appropriate WDMA and other referenced performance standards. The WDMA Hallmark is considered a mark of excellence among architects, contractors and other specifiers and is accepted industry-wide.

NATIONAL FENESTRATION RATING COUNCIL

The National Fenestration Rating Council is a non-profit organization that administers the only uniform, independent rating and labeling system for the energy performance of windows, doors, skylights and attachment products. The goal is to provide fair, accurate and reliable energy performance ratings so that:

Architects, builders, code officials, contractors, homeowners and others can compare different products and make informed product choices.

Building officials, state government employees, and others involved in code development and enforcement can determine if products meet local codes.

Government- and utility-run energy efficiency programs can establish performance requirements and standards.

Manufacturers have a fair and level playing field to compare products and an accurate method of showing the energy benefits of new designs or technology.

MINIMIZING LITIGATION RISK

Now that we've discussed considerations for window specifications and the importance of performance standards when drafting specifications, let's review a few more areas of window specifications that may help to minimize litigation risk.

Construction defect claims are one of the fastest growing areas of construction litigation and a potential source of liability for contractors and architects. One of the basic principles of construction law, the Spearin Doctrine is a legal principle that holds that when a contractor follows the plans and specifications furnished by the owner, and those plans and specifications turn out to be defective or insufficient, the contractor is not liable to the owner for any loss or damage resulting from the defective plans and specifications. The courts in virtually all states have adopted this rule and contractors are using poorly written specifications as a successful defense against defective workmanship claims.

Note: The information presented in this course is for general educational purposes and should not be considered legal advice.

The courts in virtually all states have adopted the Spearin Doctrine and contractors are using poorly written specifications as a successful defense against defective workmanship claims.

OR EQUAL CLAUSE

The 'Or Equal' clause is a provision allowing bidders to furnish items that are "equal" to the specified items. An item is considered equal if it:

- Is at least equal in quality, durability, appearance, strength, and design;
- Will perform the intended function at least equally; and
- Conforms substantially, even with deviations, to the detailed requirements contained in the specifications.

Whether or not a product can be accepted as 'an equal' depends on the criteria and expectations of the specifier and which of the elements have the highest priority to the specifier. For example, sound transmission class ratings might be more important to a commercial specifier than a residential specifier. They will determine which items must be the same and which can vary and whether a proposed product is equal in terms of character, quality and performance.

SUBSTITUTIONS

Many architectural firms have a procedure for Substitutions, which differ from 'Or Equal' in that they have some feature or attribute different or lacking in the architect's specification. These differences should be clearly stated and if acceptable to the architect, an addendum to the specification should be issued by the architect stating the acceptable changes.

Many substitutions offer items that are not comparable or may be of lesser quality than the intended specified product. Ensure that the substitution is truly comparable. Substitutions often can come in priced significantly lower but should be quantified to see if they are comparable to original specifications. Price differences can be exacerbated by options pricing, missing options or incorrect quantities. Savings on substitutions may not be or may only partially be shared with the client.

Substitution requests by vendors or subcontractors should follow the protocol outlined in Division 1. Substitution requests should be made to the general contractor who then should evaluate, approve, and forward to the architect. Approval of substitutions shall be issued as addendums.

RFIS

Requests for information (RFIs) are commonly used in the construction industry to clarify plans, specifications or other contract documents and secure a documented directive or clarification from the architect or client that is needed to continue work.

In addition to clarifying plans and specifications, the owner may allow RFIs to request approval for minor deviations from contract requirements that do not involve any time or cost adjustment, and to obtain directions on how to proceed when there are conflicting contract requirements.

It is common and accepted practice for a subcontractor or supplier to use an RFI to state his/her concern related to the omission or misapplication of a product, and seek further clarification of the building owner's intended use or the building official's acceptance of the specified product. It is also acceptable for the subcontractor to use an RFI to call attention to an inferior product that may not meet the building owner's needs, and use his/her expertise to recommend the better/correct product.

An RFI raised by the general contractor that has been answered by the client or architect and distributed to all stakeholders is generally accepted as a change to the scope of work unless further approval is required for costs associated with the change.

SHOP DRAWINGS AND MOCK-UPS

Manufacturers' shop drawings are another helpful tool to clarify complex size or unit alignments. Denote shop drawing requirements in the specifications and provide approval prior to order placement.

Mock-ups can be a very helpful tool to determine that specified materials will meet the architectural requirements and/or function as designed under specific conditions, details can be properly constructed, and it establishes the proper installation sequence of materials, ensuring the accuracy of the construction schedule. Finally, mock-ups provide installers an understanding of potential issues caused by traditional installation techniques, and may point out where other methods might provide better installation solutions.

Mock-ups can be constructed at a certified testing facility or on the construction site. The former provides a controlled indoor environment with testing equipment available at the lab's immediate disposal, while the latter allows installation in the exact climate and conditions that will occur on the building.

When a mock-up is required for testing performance compliance on a project, then the overall project documents and specifications should include the test procedures, plans and details for the mock-up. The test procedures should include specific tests to be performed, what order to conduct them, the pressures and limitations the mock-up should be tested to, what the qualifications for passing and failure are and the consequences of a failed test. This allows for the cost of the mock-up to be part of the original bid and typically accounts for a lower overall cost to construct the mock-up.

USING MANUFACTURER REPRESENTATIVES

Many product decisions are made throughout the development of the contract documents. Product representatives can be a part of those decisions by providing technical assistance to the A/E, owner or contractor in the early stages of a project and continue the assistance through the development of the contract documents. Product representatives should be familiar with the overall concepts of drawings and specifications and understand the implications of contract modifications. Thorough knowledge of all aspects of the represented product is essential when assisting the A/E with the development of the documents used for construction.

Product representatives should be technical resources for the proper use and incorporation of reference standards, specifications, testing and certification, and applicable codes. The ability to review documents and advise on a cost-effective method of installation, or to suggest a product feature or attribute that would contribute to the project's success, is an invaluable service.

By Paige Lozier, Content Specialist, Hanley Wood

Mock-ups can provide installers an understanding of potential issues and causes of failures from "normal" or traditional installation techniques prior to assemblies being constructed on the actual building.

CONTINUING EDUCATION

CREDIT: 1 LU
COURSE NUMBER: ARsept2015.2

Use the learning objectives on page one to focus your study as you read this article. To earn credit and obtain a certificate of completion, visit http://go.hw.net/AR915Course2 and complete the quiz for free as you read this article.