WHITE PAPER

Visual Acceptance Parameters for Metal Composite Material (MCM) Panels and Panel Systems

Overview

Though building and fire codes primarily address structural and fire performance of MCM cladding materials, other performance indicators often are used in the construction industry to define an acceptable application. Visual appearance is often defined in architectural specifications based on code requirements and architectural requirements beyond the scope of the code. This document defines the unified position of the Metal Construction Association (MCA) and its members with regards to visual acceptance parameters.

Background

Many exterior cladding performance requirements are defined within the International Building and Fire Codes. Fire performance, structural integrity, and allowable deflection limits are specifically defined; however, flatness and localized issues, such as denting, and colorfastness, are not specifically addressed within the code. The performance requirements for these items are often only found in the architectural specification and seldom are they an issue unless there is a visual problem with the finished building. The intent of this document is to highlight the code and industry standards for perceived "defects" in metal composite material (MCM) panel installations. This document should not be considered comprehensive, because each project and architect may have a specific set of performance requirements. Rather, this document should only be considered a guideline of areas to consider when determining whether a product is installed or performing within commonly accepted standards.

Discussion

The International Building and Fire Codes identifies the minimum performance standards required for construction; however, the codes do not address every facet of construction, and variations can still exist in the final product. These variations are often referred to as "defects," and the requirements for these items are often contained in the specifications. The primary areas of concern for this document are all in the area of visual appearance. These visual appearance items include the following:

Panel Deflection—Metal panel deflection is generally caused by two factors: wind load and thermal movement of the panel due to temperature change. Expansion and contraction, often resulting in panel bow, is most easily addressed through the use of proper design, fabrication, and installation techniques. Deflection resulting from wind load is a consideration that is specifically defined within the International Building Code (IBC). Table 1604.3 shows the deflection limits of various building components. Footnote "a" specifically covers the allowable deflection for roofing and siding made of metal sheets. A number of code inquiries have been made to the International Code Council Evaluation Service (ICC ES) over the years, and they have determined that this footnote applies to MCM cladding applications. Based on this footnote and the judgment of ICC ES, the allowable deflection of MCM cladding has been defined as L/60, which recognizes the ability of metal cladding to deflect a considerable amount and still return to its original position without yielding the material.

Many specifications also limit perimeter aluminum extrusion frame deflection to L/175. This limitation is targeted to glass supporting members for glazing applications; however, it is often defined in architectural specifications as applying to the MCM panel perimeter framing. Therefore, the panel system should be designed for this support framing deflection limit also.

Panel Bow—As discussed above, panel bow typically occurs due to restraint of a panel when subjected to a change in ambient temperature. The movement causes the panel to grow as the temperature rises and shrink as the temperature declines. These dimensional changes are always relative to the temperature of the panels during the installation process. For aluminum panels, this change in temperature can easily be 100°F and can lead to a change in panel length of 1/8 in. or more.

Panel movement of this amount may cause significant bowing if not considered in the design, fabrication, and installation of the panel. Other factors can also lead to panel bow including movement within the supporting structure that is often beyond the scope of panel system design and installation. Structural movement will often directly affect the panel sub frame. This, in turn, can impact the panel flatness. As a result, the load deflection criteria of the panel system and connection methods should be coordinated with the load deflection criteria of the primary support system in order to control movement and reduce significant panel bowing.

To address these issues prior to installation, panel fabrication typically will include slotted holes in panel framing members or use of adhesives that allow some panel movement. Panels are usually installed with a fixed point in the center of the panel, allowing for expansion and contraction of the panel in all directions from the fixed point. This technique can become particularly difficult around openings and at building corners, but proper planning will provide a solution to this construction situation. It is also important that panel installation be completed in average temperatures, consistent with the local regional average of the area. Acclimate the panels to the conditions prior to installation. Certain installations will not allow for this, but proper planning can account for this movement. Finally, consideration must be given to allow free panel movement. This means that fasteners cannot be torqued tight against connecting extrusions, effectively locking the panels in place.

MCA's position is that, as objectionable as panel bow can be on a project, the effect is generally temporary and will often subside as the panel approaches the installation temperature. If significant panel bow persists, an investigation into the installation techniques should be performed. This investigation may uncover other problems that are causing panel bow and must be addressed.

Surface Imperfections—Surface imperfections are probably the most difficult to define as they are not specifically addressed within the code. Imperfections typically include surface dents, dimples, abnormal core defects, and defects within the metal facing material. There are several standards used to evaluate building surfaces for these types of imperfections, including the Insulated Glass Manufacturers Association's insulating glass units (IGU) Guide and American Architectural Manufacturers Association (AAMA) 2605 Section 5.2, the Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels. Both standards describe a visual inspection made when standing 10 ft from the surface at a 90° angle. The inspection of the project typically is made under natural exterior lighting conditions. Imperfections are identified when viewing the cladding perpendicular to the plane of the building and should be indicated to the installer for possible remediation or replacement.

Both of these standards describe a visual inspection made when standing 10 ft from the surface at a 90° angle, typically under natural exterior lighting conditions. MCA has adopted use of these standards for metal wall cladding as an acceptable guideline for evaluation. Therefore, perceived surface imperfections should be identified utilizing those standards. If imperfections are present, they should be indicated to the installer for investigation and possible remediation or replacement.

Finish Performance and Color Fastness—While not specifically addressed in the building codes, finish criteria are often defined in detail in the project specifications. Performance characteristics including, but not limited to, hardness, impact resistance, wear resistance, humidity and corrosion resistance are defined by various ASTM) and NCCA standards.

Color fastness is measured under laboratory conditions and compares a sample of the project panel to a production control sample using one of several standard test methods. CIELAB and the Hunter L,a,b scale are often defined as a typical standards to measure the color (red, yellow, blue, green) and the lightness/darkness of the panel. The control sample is defined as the origin of a 3-dimensional grid and the panel measurement defines the relative position the project panel. The distance between these points is measured in units called "Delta E" (dE).

Lot-to-lot variation depends on the finish type. Flake-containing formulations are more variable than solid finishes and therefore should not be mixed on a single building elevation

Grain Directionality (flake orientation) within metallic- or mica-based coatings is often the source for unappealing visual appearance. Though the nature of the metallic elements suspended within organic coatings is not 100% controllable, current application technology has vastly improved consistency. Still, proper documentation and control by the MCM manufacturer and the continuance of this control throughout the design, fabrication, and installation of the MCM panel system is a must. Designers and architects must be aware that module control and limitation is critical when dealing with metallic-based coatings in order that these critical control techniques can be employed.

Typical finish warranties allow as much as 5 dE units of color change over the life of the warranty. Many factors affect the scope and term of the warranty, including color choice, application type, geography, and type of project finish. Further information on color fastness and finish performance should be obtained from the specific project panel supplier as there is a wide range of finishes and performances.

Items such as structural and fire performance are specifically defined within the code. Specific attention should be paid to Chapter 14, Section 1407, and Chapter 16 of the IBC to address these topics.

Other areas of concern that could adversely affect visual acceptance include

- field installation issues
- proper use of sealant, adhesives, and tape to avoid panel stiffener read-through
- staining of the panels during construction by materials used in other trades (mortar, sealants, cleaning materials)
- proper storage and handling practices should be addressed to protect against wet storage stains and greasy organic residue transfer, etc.
  - A cleaning and maintenance standard should be included to sustain the finish of the MCM panel systems.
- performance characteristic of the detergent resistance used for cleaning shall conform to the chemical resistance criteria specified in AAMA 2605.

MCA Comments

MCA has adopted the aforementioned standards and definitions of evaluation as acceptable industry-wide guidelines for visual acceptance parameters specifically for metal wall cladding. Following the industry standards identified within this bulletin, the architect can be reasonably assured of a level of panel quality and the expected level of panel performance. Variations in such areas as workmanship, field modifications to address unplanned variation, and site specific requirements cannot be addressed in a single document. The experience, installation practices, and quality control program of a specific fabricator and installer must be considered as a primary influence on installation quality.

Founded in 1983, the Metal Construction Association brings together the diverse metal construction industry for the purpose of expanding the use of all metals used in construction. MCA promotes the benefits of metal in construction through:

- Technical guidance
- Product certification
- Educational and awareness programs
- Advocating for the interests of our industry
- Recognition of industry-achievement awards
- Monitoring of industry issues, such as codes and standards
- Research to develop improved metal construction products
- Promotional and marketing support for the metal construction industry
- Publications to promote use of metal wall and roof products in construction

For more information, please visit the MCA Web site at www.metalconstruction.org

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