



09: HIGH PERFORMANCE ENVELOPES

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DEVIL'S DETAIL

PROCESS OF BUILDING: A COLLECTIVE EFFORT

Previously, the Devil's Details addressed the process of verifying that all components of the building envelope perform interactively and meet the requirements outlined in the project specifications. Through functional performance testing, building envelope assemblies can be tested to detect deficiencies that can result in air or water leakage. Additional diagnostic testing can be employed to examine where deficiencies exist or how they developed. Methods to verify performance have evolved as building design has become more complex and as more emphasis is placed on building envelopes.

Undeniably, the architect maintains responsibility to determine the aesthetic character of the exterior, from its overall arrangement, texture, and materials, to the proportions and profiles of building elements. However, few architects command expertise in metal fabrication techniques, and metal components play a critical role in building envelope design.

Architects may unknowingly select metal fenestration or building envelope components that do not adequately perform. Worse, if architects insist manufacturers follow design details that may be impractical, then additional liability may be placed on the architect in the case of a less-than-desirable outcome. Most successful glazing systems are the result of a team effort, where the architect, engineer, contractor, and fabricator pool their knowledge and creativity to produce a functionally and aesthetically successful design.

AAMA RECOMMENDATIONS

The [American Architectural Manufacturers Association](#) (AAMA) is a professional organization comprised of window, door, skylight, curtain wall, and storefront manufacturers, suppliers, and test labs, representing both residential and commercial applications.

AAMA recommends that with their extensive experience and knowledge of production processes and installation methods, glazing contractors and fabricators "are able to analyze the general concept, recognize potential problems, and offer suggestions that will aid the designer, facilitate production, and usually result in cost savings." AAMA cautions that, "the failure to seek such advice, and profit by it, often leads to difficulties later. It's not unusual to discover, for example, after the job is out for bids, that some parts of the wall, as detailed, are very difficult or practically impossible to produce, or that they are structurally inadequate; that the size of the wall units is such as to create transportation problems [getting the units to the construction site or into position]; that the tolerances allowed in the design are unrealistic; or that there isn't enough clearance provided to permit easy installation."

The following examples illustrate the process of designing and building evocative building envelopes that also achieve high performance standards. Achieving a high performance assembly that meets high aesthetic expectations of the design team begins with both a project's architectural concept and an understanding of the parameters that will provide the desired level of environmental control.



CONTROL IS CRUCIAL

Metal and glass are not only impermeable to moisture but also have low heat retention capacity. Consequently, they are efficient vapor barriers. Condensation control is essential in any metal glazing system design. Unless proper controls are provided, moisture or frost may occur on the interior face of the wall. Condensation may collect within the wall, potentially causing serious damage before it is detected. Fortunately, moisture control is a comparatively simple matter, provided that the problem is anticipated and preventive measures are incorporated in the wall during construction.

It is essential to understand the causes of condensation, where it will likely occur, and how to minimize its potential damage. Early dialogue with a seasoned and experienced glazing contractor or glazing system representative provides valuable input concerning the design choices to be made. Important considerations include the following:

1. A vapor barrier should be provided on or near the interior side of the wall, with specific attention given to factors of geographic location and building set points of temperature and relative humidity.
2. Impervious internal surfaces should be sufficiently insulated to prevent moisture in the air from condensing on any surfaces.
3. Provision should be made for venting vapor to the outdoors.
4. Wall assemblies should be detailed so that any condensation occurring within it will be collected and drained away.

Transitions between materials and systems can be complicated by complex geometries. Figure 1 shows the progression of a transition from design detail to shop drawing detail to field mock-up to ultimate resolution. While achieving the architect's intended aesthetic, this condition can then undergo diagnostic testing to verify performance.

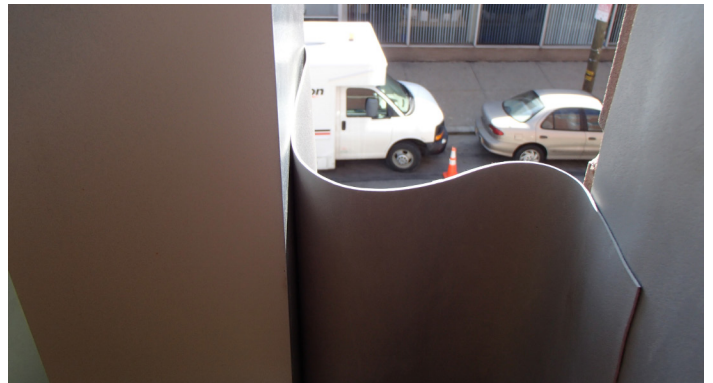
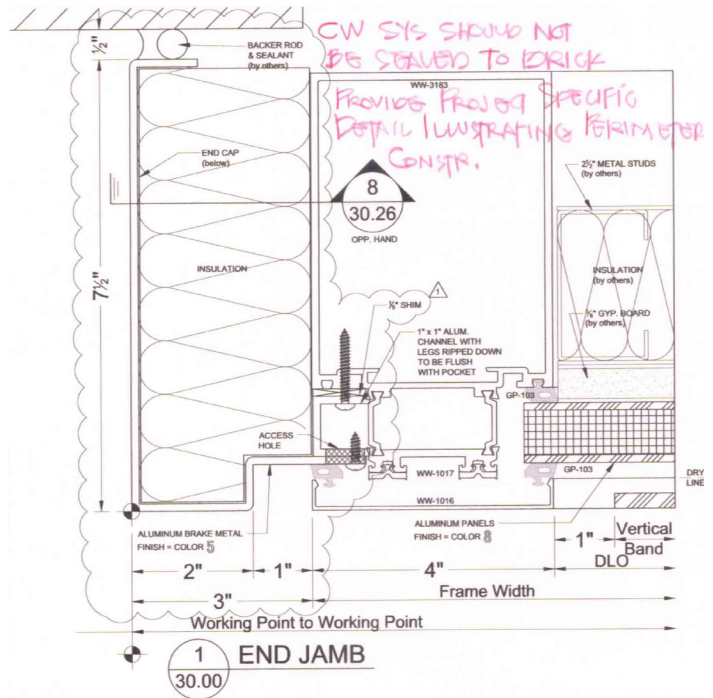
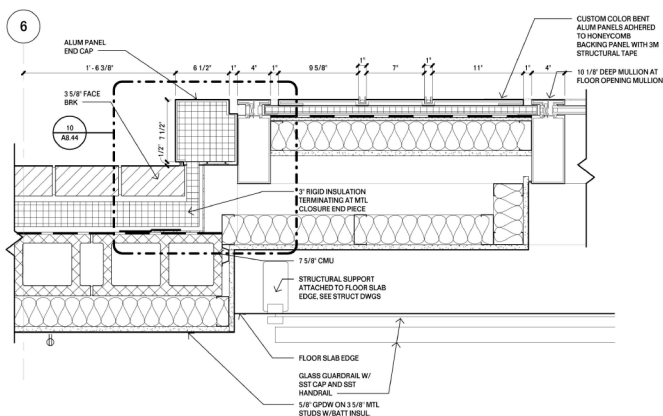


FIGURE 1: Left: Plan detail of a glazing assembly transition to masonry cladding; From top: Shop drawing detail of glazing transition to masonry cladding; proposed method for constructing an effective glazing assembly transition to masonry cladding; glazing assembly transition to masonry cladding as built; Top right: Completed glazing assembly





THERMAL CONTROL

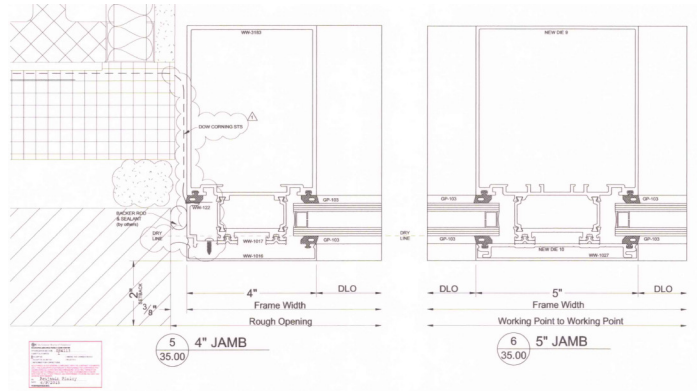
Building Science Corporation [Building Science Digest BSD-011: Thermal Control in Buildings](#) describes the importance of thermal control in buildings, from insulating properties to combating thermal bridges, heat loss to the ground, and air leakage. General thermal control best practices, as described in the digest, "require insulation layers penetrated with few thermal bridges, an effective air barrier system, good control of solar radiation, and management of interior heat generation."

In most geographic locations, the insulating value of the wall is typically a major design consideration. Whether to reduce heat loss and prevent condensation in cold weather or to minimize heat gain and air conditioning cost in hot weather, reduction in a wall's overall U-value usually provides a good, long-term investment.

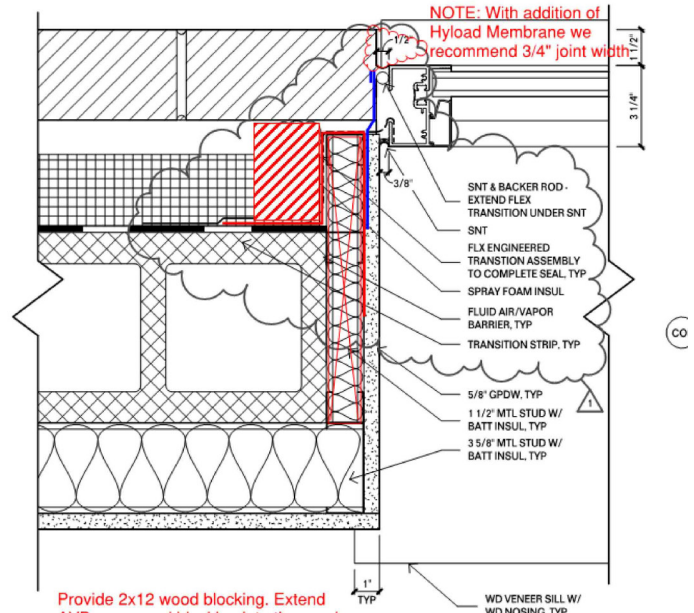
Characteristically low resistance to heat flow make metal and glass inherently poor insulation materials. However, when properly detailed, most glazing systems can be designed to provide good thermal performance. Generally, this can be accomplished by minimizing the proportion of metal framing members exposed to the outdoors, eliminating thermal short circuits by providing thermal breaks, and using double or triple glazing rather than single glazing. Incorporating super insulation in any large opaque areas of the wall assembly helps improve overall average thermal performance.

The application of code-mandated fire prevention measures and materials typically requires additional coordination and incorporation into the glazing system.

Figure 2 illustrates the progression from shop drawing detail to revised design detail where the design team addressed the required fire resistance in the assembly.



NOTE: The wood blocking could be fire treated and marry to the fire treated wood blocking at the head sim. to Dow Figure 2 Window / Door Header Detail. This would need to be reviewed with Dow. Or the brick could return to the CMU



Provide 2x12 wood blocking. Extend AVB over wood blocking into the rough opening of the window. Provide Hyload Jamb Closure Membrane adhered to AVB at wood blocking. Extend Hyload Membrane out to plane of window perimeter sealant. Seal Membrane to brick jamb with Hyload Structural Sealant.

1 EPD - TYP WDW JAMB DTL @ SECOND & THIRD FLOORS
A&T1 3" = 1'-0"



FIGURE 2: From top: Shop drawing submission for typical glazing system jamb; comments to address thermal control as a fire requirement; condition before installation of insulation and fire stopping

SOUND TRANSMISSION

The issue of airborne sound transmission through the building envelope raises consideration, particularly in dense urban areas where noise pollution and general airborne noise are concerns. In both high- and low-density environments, glazing systems can be designed to perform favorably compared with other wall assemblies.

First, understand the relationship of mass to sound transmission: sound transmission through wall assemblies is inversely proportional to the mass of the barrier. As the mass of the barrier increases, the sound transmission reduces proportionally. Although the lightweight qualities of metal glazing systems are not generally good for reducing sound transmission, metal systems can provide quiet enclosures with proper design and detailing.

Remember that the efficiency of any barrier to airborne sound depends, in large part, on its weakest link. The weak links in most wall assemblies are the glazed window openings. Where sound insulation is a concern, any leakage through the assembly will have repercussions. Design and detailing should ensure the system is as airtight as possible, such as by employing laminated glass in double- or triple-glazed configurations with well-separated and sealed framing components.

Figure 3 illustrates the progression from construction condition identified for testing, to performance testing and verification of assembly performance, to final building.

CONTINUITY IS KEY

Continuity of the various control layers (moisture, air, and thermal) is key as the design process moves from inception to construction. Collaboration of all parties involved leverages the extensive experience and knowledge of each teammate. Their specific knowledge of installation methods and fabrication techniques makes glazing contractors and fabricators uniquely suited to analyze design concepts, recognize potential problems, and suggest improvements. As design details are developed by the architect and vetted by the construction team, early fabrication and testing can validate the assembly's performance and ensure compliance with the owner's project objectives.



FIGURE 3: From top: Condition identified during construction as needing further review and assessment; testing to verify performance criteria; completed, high-performing glazing assembly

About the Devil's Details

The AGI educational series illustrates and describes common glazing challenges as a means to communicate best practices for the design and construction industry, not as a sole source for design guidance. AGI recommends design professionals consult with an AGI contractor regarding specific project challenges. AGI contractor profiles may be accessed at www.theagi.org. To share a devilish detail of your own, contact info@theagi.org.