Exploring the Dos and Don'ts of Curtainwall Transitions

Leonidia M. Garbis, PE, LEED Green Associate; and Corey C. Wowk, AIA, LEED AP

Figure 1. Unitized curtainwall enclosure.

Building designs are increasingly incorporating multiple facade enclosure systems to achieve desired aesthetics. Although the design of typical facade enclosure systems—such as a rainscreen system, brick masonry veneer wall, or curtainwall system—may individually be simple, the detailing at the transitions among these systems is a key component in designing a high-performing building facade. For example, a curtainwall system is a self-sufficient ecosystem that can be designed to meet the building enclosure's performance requirements with long-term life expectancy. However, when a curtainwall system abuts other enclosure systems (rainscreen systems, roofing, plaza waterproofing, existing structures, etc.), coordination is required to maintain continuity of the four barriers (i.e., air, thermal, vapor, and water) and deliver a watertight enclosure that meets the same performance requirements and service life expectations.

COMMONLY USED GLAZING SYSTEMS

Before discussing options for transitioning a curtainwall system to adjacent construction, it is important to understand the basics of different fenestration systems such as curtainwall, window wall, and storefront systems constructed in stick-built and unitized configurations. For each of these systems, the methodologies for anchoring the system to the structure, draining water, and accomodating movement can vary.

Stick-built construction systems are often the most economical option. They are typically purchased from a manufacturer's standard catalog, and the manufacturer can provide the designer with standard details, configurations, and options. Stick-built systems are often pre-engineered and can easily be designed for a simple building with typical spans.

Stick-built systems arrive at the construction site as aluminum extrusion "sticks" and are assembled at the site. Designers should consider that the critical metal-to-metal framing joints, which are prone to water and air infiltration, are typically sealed in the field and are susceptible to dirt and other environmental contaminants.

Unitized construction systems are assembled into panels and glazed in the factory, and then erected onto the building panel by panel (**Fig. 1**). This assembly method requires the vertical and horizontal aluminium extruded mullions to be split in half, with one half belonging to one panel and the other half belonging to the adjacent panel.

Benefits of unitized systems include faster installation in the field, which lowers installation costs. Another advantage is enhanced quality control: the critical joints are sealed in an interior, climate-controlled fabrication setting; structural glazing is monitored closely; and panels are often glazed in a clean-room-like setting to prevent dust and particles from interfering with adhesion and material curing.

When using unitized systems, designers and contractors should plan ahead because manufacturing lead time can be lengthy due to the high precision required of unitized systems during manufacutring. For projects with a short design phase and expedited construction schedule, the project team can consider implementing a design-assist approach to address lead-time concerns.

Storefront systems are typically stick built and are sometimes assembled using curtainwall components. Traditionally, storefront systems are installed at the ground floor. However, the industry may use the term "storefront system" to refer to a curtainwall or window wall system installed in a window wall configuration throughout the building.

Window wall systems vary greatly in definition and from one manufacturer to another. They can be composed of curtainwall or storefront systems, or a combination assembly of windows.

Curtainwall systems can be unitized or stick built. The difference between a true curtainwall system and a storefront system is how they

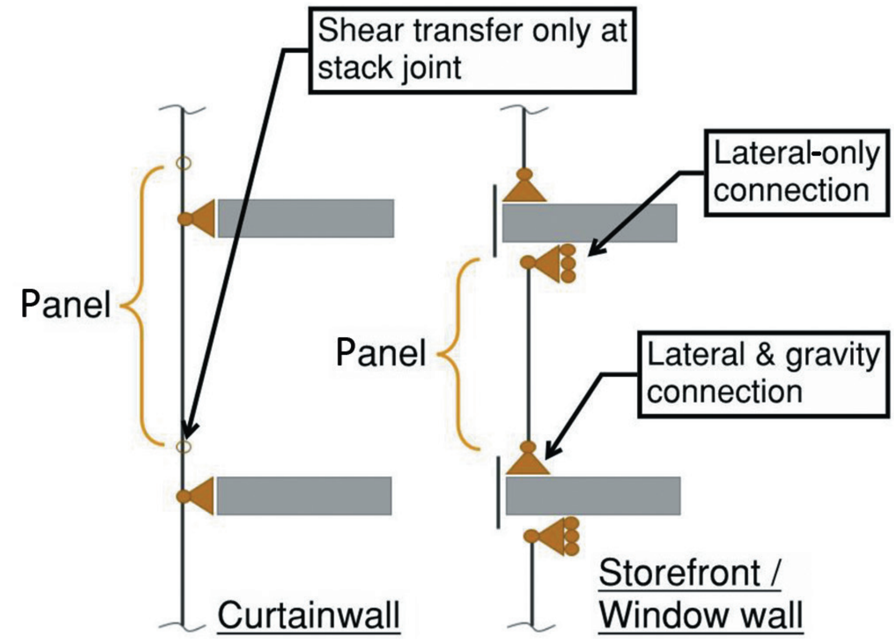


Figure 2. Fully glazed wall system structural configurations.

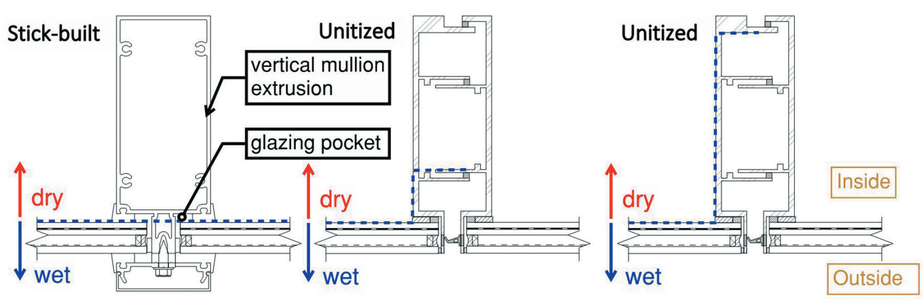


Figure 3. Drainage plane examples in plan.

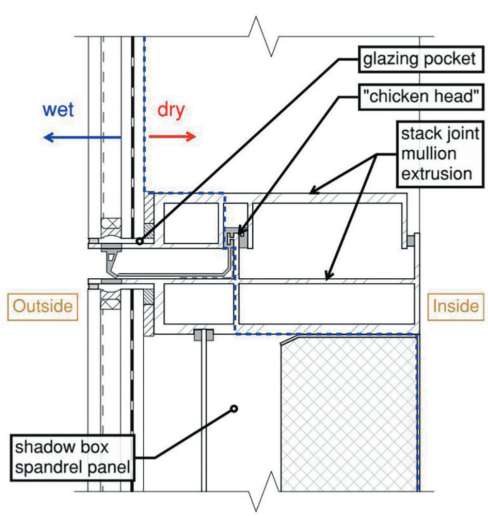


Figure 4. Drainage plane example in section.

interface with the building's structure (Fig. 2). Curtainwall assemblies typically are continuous past the floorline and installed outboard of the slab edge. In contrast, window wall and storefront systems typically span between the building floor slabs, and the slab edge condition is clad with a secondary assembly part or a different enclosure system. Any curtainwall system can be installed between slabs, with unitized systems typically requiring sill and head receptors and stick-built systems interfacing with the slab directly.

PERFORMANCE STRATEGIES

Waterproofing Methodology

The drainage plane and drainage system can vary from curtainwall system to curtainwall system. Stick-built systems with a designated drainage plane typically have a dry zone that starts at the mullion extrusions and continues to the interior, as well as a wet zone that starts from the glazing pocket and continues outward. Water that finds its way behind the exterior gasket, sealant joint, or pressure cap can be drained out of the system.

The waterproofing methodologies used in unitized systems can vary greatly. In some unitized systems, the wet-dry line is close to the glazing pocket; this is also often the case with stick-built systems. In other unitized systems, the wet-dry line is recessed to an interior chamber, or the wet zone extends to the interiormost leg of the system (**Fig. 3**). Note that in the figure the wet-dry line is shown diagrammatically to represent how far into the interior the wet zone can extend. The farthest point may occur at the horizontal mullions below or above the glazing.

In some instances, the wet zone varies within the system. For example, it may be recessed to an interior chamber at the stack joint gasketed legs (commonly referred to as the "chicken head") and then extend to the interior edge of the system within a spandrel zone backpan below or above the stack joint (**Fig. 4**).

Most curtainwall systems have an internal drainage system; however, some are face sealed. These systems rely on a barrier approach, where the outboard seals and gaskets are intended to block 100% of water entry. Although the typical details may include exterior gaskets, which give the impression that there is a wet zone behind the exterior seal, the system may not be designed to accommodate water within that zone. In some instances, the system may not accommodate water in that zone because the gasket ends are not sealed against one another to create a watertight barrier. Common systems that are face sealed include cassette systems and toggle glazing systems. It is important to note that systems from some manufacturers will accommodate drainage behind the exterior seal. Maintaining the seals and exterior gaskets of face-sealed systems is an important part of maintaining a watertight enclosure that meets the enclosure's performance requirements and service life expectations.

When an enclosure design involves a curtainwall system, the designer should review the manufacturer's information and discuss the system with them to clarify how it is assembled, how it accommodates movement, where the drainage plane is located, and how water is drained through the system. The intricacies of each system are not clear from standard details alone, especially because the drainage paths are sometimes circuitous. The drainage plane can move in and out of the system, and some systems are designed to drain water within the full height of the panel below before water is directed to the exterior of the facade.

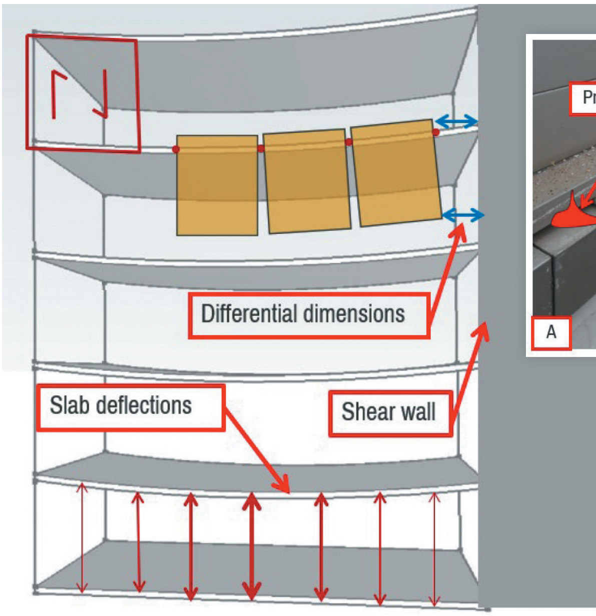


Figure 5. Curtainwall panel movements.

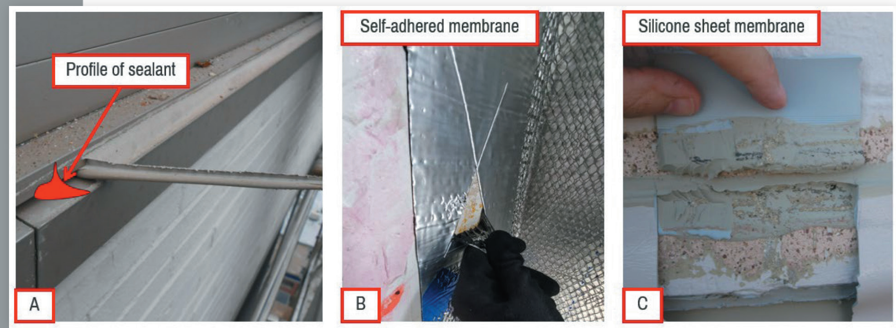


Figure 6. Adhesion testing of different transition materials: (A) profile of sealant; B) self-adhered membrane; and (C) silicone sheet membrane.

Movement Accommodation

When designing the interface between the curtainwall system and the adjacent enclosure system, it is important to analyze building movements and tolerances. Typically, a curtainwall system is designed to accommodate movement within the system. For example, a slab-supported system hung from an upper floor should be designed to accommodate slab deflection, allowing for larger movements at the base of the panel than at the top (**Fig. 5**). If the adjacent system (for example, a shear wall) is not designed to move in the same way, the perimeter transition must accommodate differential movement within the joint. In this instance, a sealant joint without movement capacity will separate and permit water infiltration at the transition.

Different curtainwall systems, particularly unitized systems, move differently. Some are designed to shear, some have joints that open and close, and others may structurally connect panels from floor- to-floor to prohibit certain movements. Understanding how the curtainwall will move is key in designing the perimeter tie-in to accommodate the anticipated movements.

Tolerances should also be examined, particularly with stick-built systems, which are typically delivered to site already cut to a specified length. Often, the type of curtainwall system and its dimensions are decided before field measurements of perimeter conditions can be acquired; therefore, joints must be sized during design to accommodate the tolerances. Typically, building slabs and concrete walls or curbs may have a ±1 to 1.5 in. (± 25 to 38 mm) construction tolerance, which may lead to either a 2 in. (51 mm) perimeter sealant joint or limited space, making curtainwall installation difficult. Discussing these tolerances with the contractors and confirming with the design team (which should also include the structural engineer) during the design phase that the perimeter transition methodology can accommodate them helps prevent installation difficulties during construction. Depending on the perimeter tolerances and the level of uncertainty during design, the designer can include subheads or subsills, which can reduce the risk of these complications by allowing for movement within the system, rather than relying on perimeter joint fixed dimensions.

TRANSITIONS AND THEIR CHALLENGES

As noted, the interfaces between the curtainwall system and adjacent systems must accommodate anticipated building movement, waterproofing tie-ins, air barrier and thermal continuity, and construction tolerances, which may vary system to system. Maintaining air and water infiltration performance can be a significant challenge. The designer must consider the drainage approach of the curtainwall system, as well as that of the adjacent system, to determine how to best detail the interfaces. Face-sealed barrier systems rely on the exterior barrier face seal, but they could incorporate a drainage pan at the sill. Systems with internal drainage typically require a waterproofing tie-in at the drainage plane of the system. The designer may identify multiple potential tie-in locations depending on the system and location of its drainage plane. When choosing which location to use, the designer should ensure that they understand the drainage plane to prevent blocking the internal system drainage and trapping water within the system.

Transition Materials

Materials used for transitions at the system interfaces include sealant and sheet membranes. The sheet membrane can be either a weather-resistive barrier (WRB) self-adhered sheet or a silicone sheet membrane. Sealants and sheet membranes can both be used successfully when properly installed. Field experience indicates that compared with a sealant joint, a sheet membrane can be more forgiving in its installation and can span greater distances between systems.

Sealant joints must be designed with sufficient width for movement, a depth-to-width ratio of 2:1, adequate sealant thickness, and consideration for the desired tooling aesthetic. Proper installation is key to sealant joint integrity and function throughout a lifetime of exposure to the elements, expansion and contraction, temperature variation, and wetting and drying. Sheet membranes must be designed with sufficient bellows for movement, positive lapping of the membrane, and consideration for how to treat lap joints.

During installation, the installing contractor should verify material compatibility of the sealant or sheet membrane with all adjacent materials, prepare the surface per the manufacturer's recommendations, provide sufficient backing material, and confirm installation temperature limitations are met. A significant challenge with sealant installation is providing a tooled joint that meets the dimensional requirements recommended by the manufacturer and industry standards. A challenging aspect of self-adhered membrane installation is removing wrinkles, air pockets, and fishmouths. Material compatibility testing reports and adhesion testing reports from manufacturers can help designers and contractors determine whether a primer or other special surface preparation is required.

Adhesion pull tests are an effective way to evaluate sealant and membrane installation and adhesion in the field. During the preconstruction phase, such tests can be used to assess whether primer or other special surface preparation is required. During construction, they can be used as a quality control measure (**Fig. 6**). Most adhesion pull tests are qualitative. With successful adhesion, it is very difficult to pull and remove the sealant or self-adhered membrane (Fig. 6A) from the substrate. In contrast, when a sealant joint profile is not shaped properly (Fig. 6B), the sealant does not adhere to the adjacent surfaces and can often be pulled across an entire length with little effort during an adhesion pull test (Fig. 6B). Similar testing can be performed on silicone sheet membrane set in silicone sealant (Fig. 6C).

TYPES OF TRANSITIONS TO OTHER SYSTEMS

There are three typical curtainwall tie-in conditions to consider when designing the sill, the head, and the jamb. Although the curtainwall sill may transition to below-grade waterproofing in one instance and an adjacent terrace roof in another, the principles are the same in either situation.

Below-Grade Transitions

When designing a transition between curtainwall and below-grade or plaza waterproofing, the designer should consider providing a curb for the curtainwall (**Fig. 7A**) to protect the glazing from adjacent foot traffic, prevent moisture or snow accumulation against the glazing (in climates where snow is likely), and provide sufficient height to transition between waterproofing membranes. The designer should confirm waterproofing product compatibility and positively lap (otherwise known as ship lap or shingle lap) sheet membrane from the curtainwall system to the below-grade membrane. The membrane can terminate directly onto the starter sill of the curtainwall, but it is important to ensure that the curtainwall drainage path weeps are not blocked—blocking them would not allow water to drain from the curtainwall system to the exterior. With any curtainwall sill condition, the installer will likely need to mill out the tongue (Fig. 7B) of the vertical mullion to align it with the horizontal mullion, providing a continuous surface onto which the waterproofing can adhere. The designer and installer should note that additional coordination may be required, as the extrusion may leave small gaps or spaces where a plug, adapter, extruded end piece, or seal may be needed to provide a continuous airtight and watertight perimeter (Fig. 7C).

Roofing Transitions

In many respects, the design and installation principles for curtainwall to roofing transitionsare the same as those for transitions to below-grade sill conditions (**Fig. 8**). However, it is important to note that the roofing membrane will typically not tie directly onto the curtainwall sill; this is often due to construction sequencing and scheduling constraints.

As with any membrane transition, compatibility is important in curtainwall-to-roofing transitions. Notably, many roofing products are not compatible with WRBs or silicone sheet membranes. In these instances, the designer may specify a sheet metal separation strip that can double as a mechanically fastened termination for the roofing membrane.

When roofing transitions to curtainwall at parapet conditions (**Fig. 9**), the curtainwall head condition requires the designer to consider how the waterproofing will transition into the drainage plane of the system and perhaps into the glazing pocket. Similar to the sill condition, understanding how the vertical mullions meet the horizontal mullions is important to maintain a continuous waterproofing surface. Most curtainwall systems require end caps at the top of the vertical mullions where the horizontal mullions meet the vertical mullions. Sealing this end cap with a silicone sheet patch at the splices will provide a termination and watertight transition within the curtainwall system.

The coping cover design must comply with project wind uplift requirements, which often limit the available options. When possible, the designer should discuss options for fastening the coping to the curtainwall and parapet vertical sections and sealing penetrations through the waterproofing membrane to provide the most robust detailing. The coping itself will likely need splices because manufacturing, shipping, and handling requirements limit the lengths of coping components. These splices should be designed to accommodate anticipated movements, including thermal expansion, as well as waterproofing continuity. Accommodating these conditions often requires a membrane lapping between splices with a splice cover to protect the membrane from exposure and provide a continuous aesthetic.

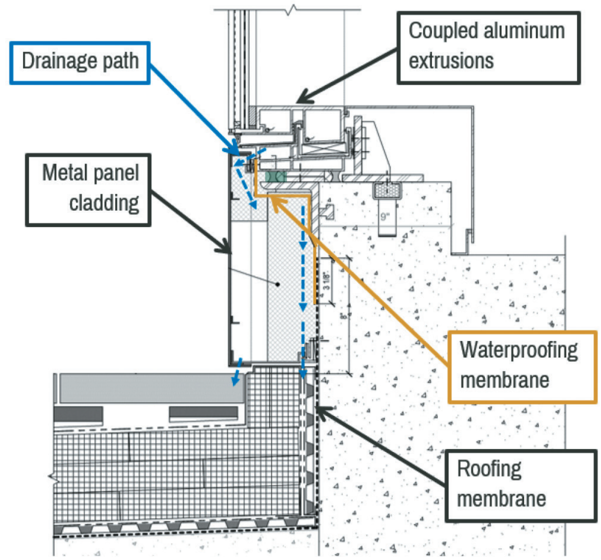


Figure 8. Section at curtainwall sill to roof.

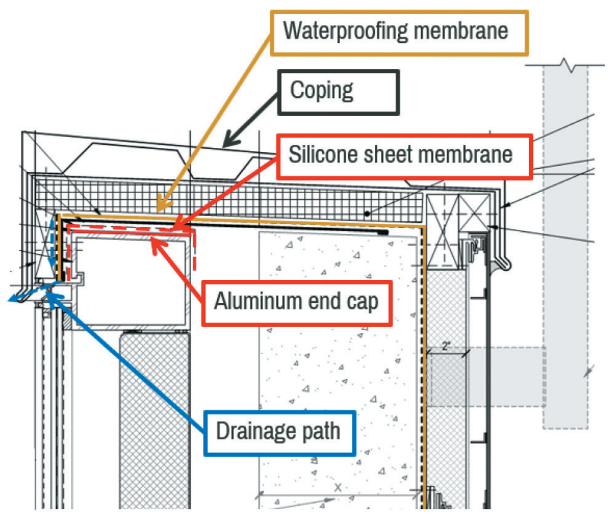


Figure 9. Section at roof coping.

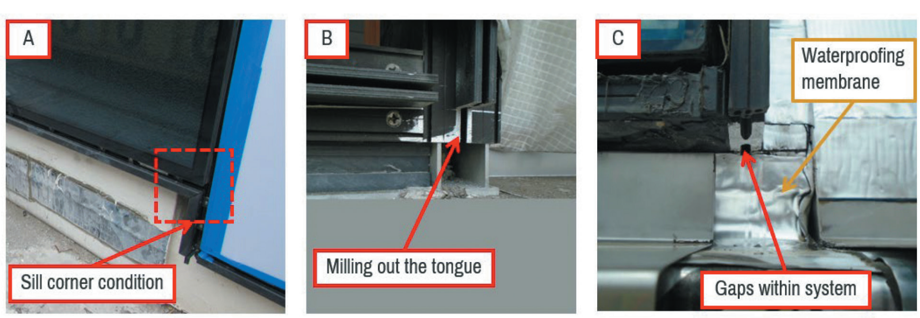


Figure 7. Transition at curtainwall sill: (A) sill corner condition, (B) milling out the tongue and (C) gaps within system.

Figure 10. Transition options to curtainwall jamb: (A) detail; (B) transition with WRB directly; and (C) transition with silicone sheet. Note: WRB = weather-resistive barrier.

The designer should discuss any warranty limitations at the transition with the manufacturers of both the roof and the curtainwall. Ultimately, both manufacturers should review and approve the transition details.

Rainscreen System Transitions

For the purposes of this article, any wall system with a designated WRB membrane, including brick masonry veneer walls, is classified as a rainscreen system. At the transition between the curtainwall system and one of these assemblies (regardless of the type of exterior cladding), the WRB should interface with the wet-dry line of the curtainwall system. With rainscreen system transitions (**Fig. 10A**), the designer can transition the WRB directly onto the curtainwall perimeter framing (Fig. 10B) or include a transitional silicone sheet membrane between the WRB and the framing (Fig. 10C). In either approach, the design principles are similar to those previously discussed for sill and head conditions. In particular, it is important that the drainage path of the curtainwall is not blocked. It is good practice to provide sheet metal flashing above the curtainwall head condition where the rainscreen system ends. The flashing will shed most water outboard of the curtainwall system and will only allow incidental water to bypass the flashing and drain through the curtainwall drainage system.

Considerations for transitioning a curtainwall system jamb to a rainscreen system are similar to those for transitioning to the roof coping. For example, a sealed end cap may be required at the starter sill or stack joint to close off the system and provide a continuous surface for the waterproofing (Fig. 10B). The designer should also note that curtainwall systems with wet-dry lines that extend past the glazing pocket should have a silicone boot (Fig. 10A), or something similar, at the stack joint or starter sill; to create an end dam within the curtainwall system and prevent water from traveling into the adjacent system.

Transitions to Existing Building Conditions

Installing new curtainwall within an existing opening can a be a complicated endeavor. There are typically locations where you need the building structure to exist to support not only the new curtainwall, but also the transitional waterproofing between the curtainwall and existing building's cladding. With these types of existing building projects, it is important for the designer and installer to carefully review existing drawings and plan for probe openings to better understand the construction. If the existing building conditions provide sufficient space for installation at the perimeter of the opening and behind the existing facade, the designer may be able to add transitional membrane strips to tie into the curtainwall system and protect the perimeter. In some cases, there may be space for new perimeter insulation as well as sheet metal flashing to direct water away from the curtainwall at the head condition, drain water from the curtainwall to the exterior of the existing facade at the sill of the system, and limit water and create a clean finish at the jamb conditions.

There may be surprises during construction, as no two buildings are the same. In some cases, every opening within a building may be different.

Mass Masonry Wall Transitions

In some instances, options for transitioning to the adjacent system may be limited. For example, the designer may have only a few choices when considering how to transition to adjacent precast concrete, a multiwythe brick masonry wall, or a face-sealed system. At a minimum, in these instances, the transition can incorporate a flexible sheet membrane, such as silicone sheet, tying into the glazing pocket of the curtainwall system and sealing against the adjacent system (**Fig. 11**). An exterior perimeter sealant joint can be installed; however, the sheet membrane provides a secondary long-term drainage solution in the event the exterior sealant joint fails.

TYPICAL TRANSITIONS WITHIN A CURTAINWALL SYSTEM

A designer may need to consider transitions within the curtainwall system itself. Design issues may include incorporating doors, louvers, or packaged terminal air conditioner (PTAC) units, or providing expansion joints.

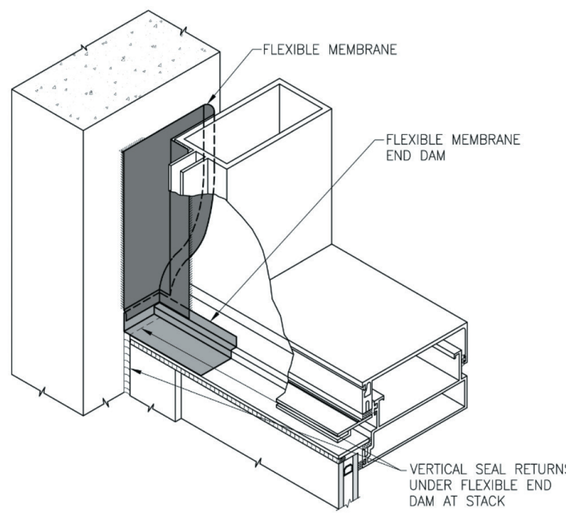


Figure 11. Flexible membrane transitions.

Door Transitions

Integrating a single-leaf terrace door within a curtainwall system is relatively simple if the door fits within the typical curtainwall panel width. For unitized systems, manufacturers may be able to install single-leaf doors within the panel at the factory.

A double-leaf terrace or entrance door, which may be required for egress, is typically too wide to fit within a panel, and having a vertical mullion at the middle interferes with the required larger egress span. For projects where a double-leaf door condition occurs repetitively, it may be worthwhile to discuss with the manufacturer whether it can manufacture a custom transition panel for use at the doors. For projects with a handful of these doors, the designer can consider transitioning the unitized curtainwall system to the manufacturer's standard stick-built system, which can accommodate double-leaf entrance doors (**Fig. 12**).

During design, the designer should note where and how each system is supported. For example, stick-built systems with doors may need to sit on the slab, whereas a unitized system may be hung from the slab above. In the latter situation, it may be necessary to first provide a transition to a unitized panel that sits on the slab before transitioning from the unitized system to the stick-built system on either side of the door. With all door conditions, the designer and curtainwall manufacturer should consider the three-dimensional interface at the sill corner where the roofing or below-grade waterproofing transitions to the curtainwall and the door threshold.

Louver Transitions

Unitized curtainwall manufacturers may integrate louvers into the panels. However, the mechanical ductwork connection to the curtainwall is often not coordinated, creating potential for water and air leakage into the interior. When transitioning curtainwall to PTAC units, the designer can transition a PTAC sleeve into the glazing pocket of the curtainwall system and provide waterproofing. It is important that the transition design allows for differences in PTAC and curtainwall movement—for example, the PTAC unit may be supported from the floor slab while the unitized curtainwall panel is hung from the slab above. The perimeter tie-in can include insulation to limit thermal bridging at the sleeve and sheet membrane to provide a flexible air seal between the curtainwall and sleeve.

Designers should note that regardless of louver water performance ratings, louvers often allow water to bypass the blades. Therefore, any transition to PTAC sleeves or other ductwork should anticipate some water infiltration. In some designs, this water can be drained to the exterior by providing a sloped bottom to the sleeve or duct, and be wept through the curtainwall system.

Expansion Joint Transitions

Expansion joint detailing is similar to interfacing with an adjacent rainscreen system as the flanges of the expansion bellows tie into the curtainwall system glazing pocket. This is the case both for expansion joints within curtainwall systems and when a building expansion joint is used at a transition to an adjacent rainscreen or roof system. How each system will move, the direction of the movements, and the anticipated total movement are important when designing expansion joint transitions. The designer should also ensure that the design addresses the movement from the outermost (metal panel expansion joint cover) to the innermost (interior finishes) transition. If the design does not account for this movement, the joint covers or interior finishes may crack and deform.

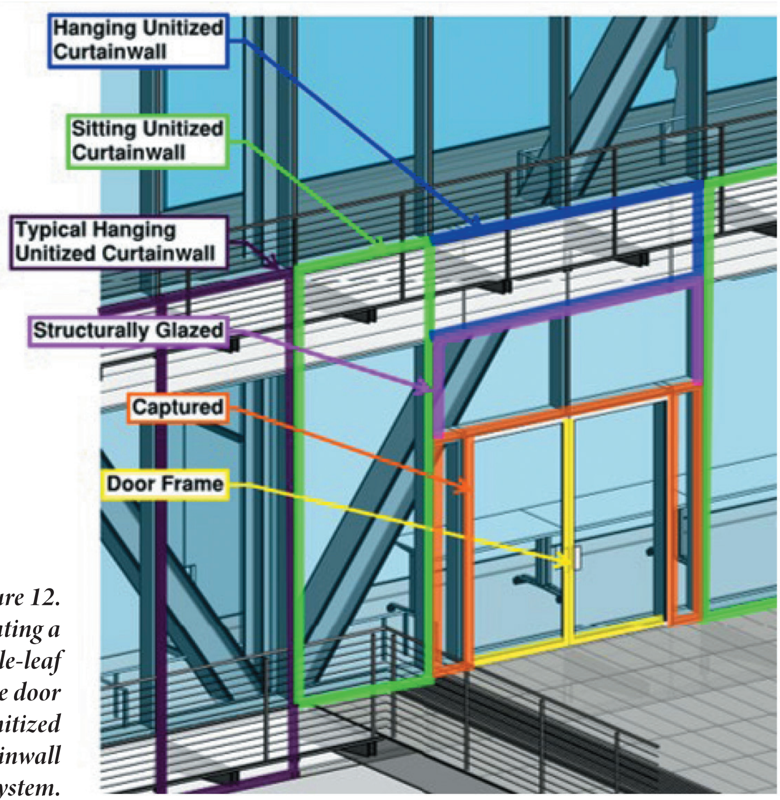


Figure 12. Integrating a double-leaf terrace door into a unitized curtainwall system.

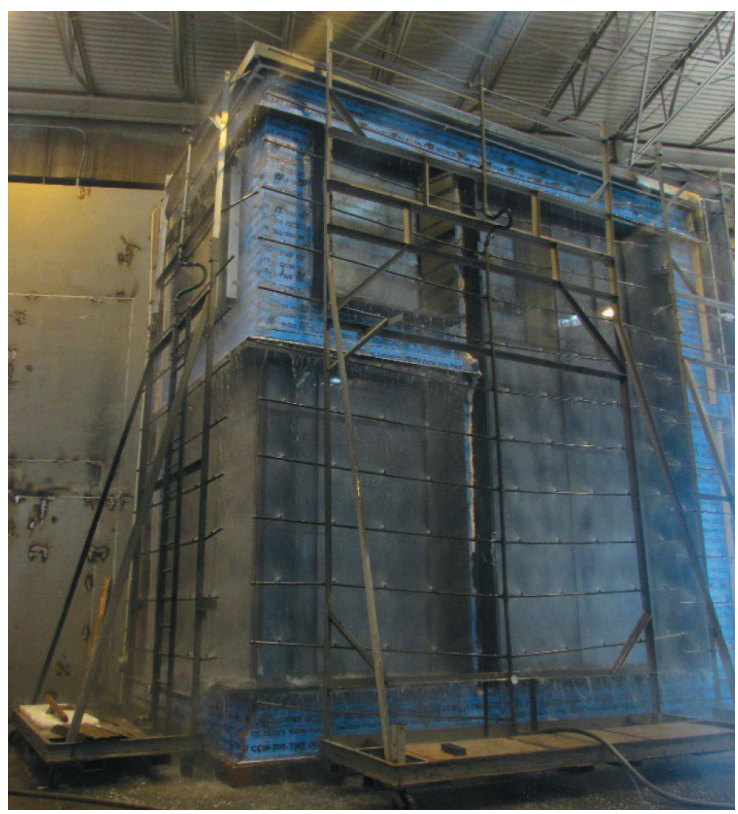


Figure 13. Preconstruction mock-up used for water testing.

BEST PRACTICES FOR EXECUTION

Shop drawings, preconstruction mock-ups, and field testing are key items during the construction phase. Their use can help the project team coordinate system interfaces and successfully install transitions that meet the project performance requirements.

Shop Drawings

Shop drawings illustrate the intricacies of the selected systems. Designers can use them to confirm how each system is assembled, how it accomodates movement, where the drainage plane is located, and how water is drained through the system.

On some projects, each trade will submit separate shop drawings and may not fully coordinate their drawings and work plans with those of the adjacent trades. However, contractors should work together, along with the design team, to develop coordinated shop drawings for key transition details that show the extent of work for each trade. In some circumstances, three-dimensional details may be needed to fully capture the scope of work, especially when there is a change in plane for the waterproofing. By developing these details together, each trade can present their specific concerns to the team and each trade can then take ownership of their part of the transition.

Preconstruction Mock-ups

Fenestration system manufacturers test their systems to rigorous industry standards. However, the manufacturer's standard performance testing may not provide sufficient information about the performance of customized curtainwall systems or project-specific transitions from a curtainwall system to an adjacent system. Preconstruction mock-ups (**Fig. 13**) offer an opportunity for different trades to work together and coordinate the sequencing and installation intricacies required at each transition detail.

Mock-ups can be built in a laboratory testing facility, or they may be constructed on site (unless on-site testing is impractical due to project site constraints or the size of the mock-up). In either case, testing of mock-ups can verify that the curtainwall system and transitions to adjacent construction are properly detailed, manufactured, and installed to meet the project performance criteria. Testing can include air and water infiltration tests amd structural loading of the systems, as well as movement tests where each system or the structural member(s) to which it is attached is moved, creating anticipated project conditions. In short, mock-up testing is a way to verify that the design will work as intended.

Field Testing

Designers and owners may specify field testing as part of the construction quality control plan. Testing performed early in the construction phase can help identify problematic locations and help develop repairs before systems are fully installed. Field testing also offers an opportunity to confirm that transition details perform as anticipated after installation and provide an opportunity to make any appropriate adjustments to the design.

Depending on the project performance requirements, field testing can incorporate a large array of tests. The simplest field test for a contractor to perform as a quality control measure is AAMA 501.2[1] nozzle testing, although some transitions and projects would benefit from dynamic water testing (AAMA 501.1[2]) or water testing with a pressurized chamber (ASTM E1105[3]).

For some projects, designers and owners may require testing to be performed by a third-party independent testing agency. Designers and owners should discuss field testing requirements during the design phase. Such discussions will help designers determine how many tests, what kinds of tests, and what locations to specify. With all field testing, it is important to coordinate sequencing of interior finishes and adjacent work with the contractors.

CONCLUSION

When interfacing a curtainwall system with adjacent systems, designers and contractors should apply building enclosure best practices for detailing watertight enclosures. On a successful project, team members will identify all transitions that require careful coordination and collaborate to maintain continuity at the interfaces between adjacent enclosure assemblies. Performance mock-up testing and quality control field testing during construction provide confidence in the design and help ensure that coordination and sequencing concerns are addressed in the early stages of construction. Designers should communicate, plan, and coordinate interfaces between curtainwall systems and other systems from the early stages of design through construction. Partners in communication, planning, and coordination may include structural or mechanical engineers, the various material and system manufacturers, the installers, and other project stakeholders.

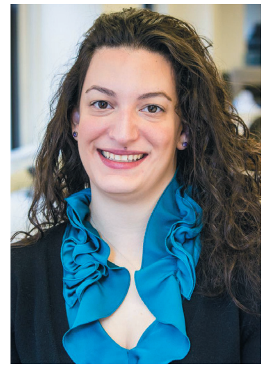
REFERENCES

1. FGIA. 2015. *Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls and Sloped Glazing Systems* (AAMA 501.2-15). Schaumburg, IL: FGIA.
2. Fenestration and Glazing Industry Alliance (FGIA). 2017. *Standard Test Method for Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure* (AAMA 501.1-17). Schaumburg, IL: FGIA.
3. ASTM International. 2015. *Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference* (ASTM E1105-15). West Conshohocken, PA: ASTM International.

Please address reader comments to:

chamaker@iibec.org, including "Letter to Editor" in the subject line, or IIBEC, IIBEC Interface Journal, *434 Fayetteville St., Suite 2400, Raleigh, NC 27601.*

ABOUT THE AUTHORS



Leonidia M. Garbis, PE, LEED

Leonidia M. Garbis, PE, LEED Green Associate, is a senior consulting engineer in the Building Technology Group at Simpson Gumpertz & Heger (SGH). She has nine years of experience in the engineering and construction industry and specializes in the design and evaluation of new and existing building enclosures. Garbis has extensive experience designing and detailing custom curtainwall assemblies from design through construction administration. Her new design experience includes commercial, multifamily residential high-rise, and infrastructure projects. In addition, Garbis has experience in enclosure forensic engineering, including investigating curtainwall and custom glazing systems. She has experience with a variety of facade, roofing, and waterproofing systems. Garbis is an active member of the Commercial Real Estate Women Network and the Association of Medical Facility Professionals.

Corey C. Wowk, AIA, LEED AP

Corey C. Wowk, AIA, LEED AP, is a senior project manager in the Building Technology Group at SGH and has over 17 years of experience in the architecture, engineering, and construction industry, designing, investigating, and rehabilitating curtainwalls, windows, rainscreens, roofing, and below-grade waterproofing. He has worked on both small- and large-scale projects, including residential and commercial buildings, mixed-use high-rise facilities, and institutional projects. Wowk is a visiting professor at Pratt Institute's Graduate Architecture and Urban Design Program with coursework focused on integrated building systems. He is a member of the Rainscreen Association in North America Performance Committee and the American Institute of Architects New York Chapter.