Construction Administration Tools Address Unusual Building Enclosure Conditions

By Bob Sanderson, RRC, REWC

Successful termination of building veneers to roofing systems involving atypical conditions requires carefully detailed drawings. However, in the design development and construction documentation phase for a new building, architects and engineers typically have limited time to detail every condition necessary to properly communicate design intent, material usage, and the interaction of materials for the building enclosure's exterior walls and roof assemblies.

Two construction administration tools that can help overcome the challenges of atypical building enclosure conditions are mock-ups and preinstallation meetings. The purpose of this article is to bring attention to building enclosure roofing conditions that benefit from application of these tools (and others), thereby helping building owners avoid unnecessary, disruptive, and costly building veneer repair or replacement projects when roofing materials require maintenance or reach the end of their useful service life. Case examples from the field are presented to illustrate the short- and long-term risks to the building enclosure associated with insufficient communication and coordination between design teams, construction managers, general contractors, and subcontractors.

BACKGROUND

In the design development and construction document phase of most projects, much of the architects' and engineers' time is allocated to the development of "big picture" items such as floor plans, reflected ceiling plans, roof plans, building elevations, wall sections, door and window schedules, plan details, interior finishes, and editing of specification sections. In whatever time remains, the design team usually will focus on finalizing the contractor bid set on "common" or "typical" door and window details, enlarged flashing details, termination details, and transition details between dissimilar building materials. These common or typical details will address many conditions that will be encountered during the project. However, they do not capture every condition. Given the complexity of today's buildings and compressed schedules, it can be challenging to sufficiently focus on unusual conditions in the construction document phase.

Because not all conditions can be fully addressed and detailed in the construction document phase, designers may rely on typical manufacturer installation details to establish a baseline for a predetermined level of construction quality intended to address the complexities of atypical or uncommon building conditions. Architects and engineers also may give unusual building conditions additional attention during the bid phase as an addendum item, or in the construction administration phase as architectural supplemental instructions, a response to a contractor request for information (RFI), or a request for proposal.

Even when architects and engineers make such efforts, uncommon or atypical building enclosure conditions still may remain unresolved and undetailed after the completion of the bid phase. This fact underscores the importance of contractor mock-ups and preinstallation meetings to address these types of building enclosure conditions. Both of these construction administration tools help the designers, owner, and contractor team interact, communicate, and develop solutions in the field for unusual building conditions, thereby establishing an understanding among all parties involved as to what installation expectations will be. Use of these tools also underscores the importance of establishing a sufficient level of quality control for material applications, differing material interactions, future material maintenance or replacement, and evaluation of building enclosure testing procedures.

MOCK-UPS

Mock-ups often are used to evaluate and refine the aesthetic aspects of a building design. However, when building enclosure mock-ups are accurate, full-size representations of a proposed design, they also can be effectively used to assess the building enclosure's future performance. In particular, testing mock-ups that represent unusual or atypical building enclosure conditions may reduce the need for costly rework and eliminate delays during the actual project.

When using mock-ups of an exterior wall and roof assembly to evaluate thermal, water, air, and vapor issues, it is important that construction techniques associated with the mock-ups comply with material manufacturer installation instructions and relevant ASTM International standards for quality control testing procedures, including ASTM E783[1] or ASTM E1186[2]

Figure 1. Mock-up panel illustrating several key attributes of a comprehensive evaluation of an exterior wall and roof assembly. Figure courtesy of Walsh Construction Co.

for air leakage testing and ASTM E1105[3] and ASTM E2128[4] for water leakage penetration testing. Complying with minimum ASTM testing standards establishes a baseline of acceptable construction methods and quality control for the exterior wall mock-up.

At a minimum, building enclosure mock-ups should include a typical exterior wall; however, it is the opinion of this author that atypical conditions such as inside and outside building corners, windows, and the top of wall-to-roof assembly also should be incorporated into the mock-up. The addition of these components helps the project team evaluate the perimeter continuity at transitions where exterior walls turn directions, as well as flashing conditions at window and door rough openings, and conditions where the exterior wall's continuous insulation, air, and vapor barrier system transitions to vapor barrier components associated with the roof assembly (**Fig. 1**).

PREINSTALLATION MEETINGS

As noted previously, another critical component to evaluate uncommon building enclosure conditions is the preinstallation meeting. Its primary purpose is to address a specific issue or an array of topics. However, an added benefit of a preinstallation meeting is that it is an opportunity to discuss those atypical and complex building enclosure transitions and geometry that are not reflected in a typical mock-up assembly or in the construction documents. It is at this point in the construction administration process that project team members can review together the uncommon building enclosure conditions and coordinate the sequencing of construction to address issues such as aesthetics; compliance with manufacturer-recommended installation details; thermal, air, and water infiltration; vapor drive performance; and long-term maintenance (see "Keys to Successful Preinstallation Meetings" sidebar).

If the construction documents do not provide a plan for efficient future material removal and replacement when building materials approach the end of their expected life expectancy, creating such a plan is another key objective for this meeting, as this plan will be important to minimize disruption to other building veneers and systems when

Keys to Successful Preinstallation Meetings

- **Early in the construction administration phase, identify building enclosure–related areas of concern that warrant special attention.**
- **Have the construction manager (CM) or general contractor (GC) incorporate mock-up reviews and preinstallation meetings for unique building enclosure conditions into the construction schedule as milestones. This helps ensure that these conditions can be discussed in advance and in a timely manner.**
- **Include all relevant stakeholders in the meetings. The recommended attendees are:**
  - **The owner or their representative**
  - **The architect**
  - **Engineering consultants**
  - **The CM or GC**
  - **Building enclosure consultants (RBEC, RRC, RRO, RWC, REWC, REWO)**
  - **Roofing and sheet metal contractors**
  - **The roofing membrane manufacturer's field service technical representative**
  - **Product representatives or technical support staff for the manufacturers of exterior wall components (for example, representatives for the sheathing, air barrier, continuous insulation, and veneer material companies)**
  - **Representatives for other trades affected by the tie-ins to roofing termination conditions**
- **If possible, meet where the project mock-up is located or at the in-situ location site.**
- **Ensure that the meeting agenda includes the "nuts and bolts" of how all the building components interact; exterior wall air and vapor barrier to roof vapor barrier continuity tie-ins; the sequence of construction; flashing conditions; flashing elevations to maintain proper clearances above the tops of parapet wall elevations; aesthetics; and how to maintain access to roofing terminations and accommodate future maintenance and replacement of building material without disruption to adjacent building veneer systems.**
- **Allow time to discuss additional topics such as procurement of materials; coordination of trades; recommended material installation instructions and procedures; requests for proposals; and how the top of the parapet wall interacts with other building elements such as face brick, stone, precast concrete, aluminum composite material panels, exterior insulation and finish systems, and aluminum windows and curtainwalls.**
- **Focus the meeting on maintaining access to roofing termination details and establishing proper flashing heights above top-of-parapet wall elevations where a parapet wall terminates into a building element that extends higher than the top of the parapet.**

Figure 2. A thermoplastic polyolefin–clad parapet wall transition to a field-trimmed aluminum composite material condition.

adjacent building materials require repair or replacement. When the time for replacement arrives, clear communication will be necessary among the various trades playing an interactive part in completing the termination, and the foundation for that communication can be built during the preinstallation meeting by setting a shared understanding of expectations about the performance and success of future maintenance and replacement work.

ALTERNATIVE INFORMATION SOURCES AND CONSTRUCTION ADMINISTRATION STRATEGIES

On some projects, construction managers, general contractors, and their subcontractors may not find sufficient detailing in the construction document set, and the project may not include mock-ups or preinstallation meetings to address uncommon building enclosure conditions. In these situations, the contractors may be put in a position to figure out among themselves how they will proceed. Ideally, contractors will have additional tools at their disposal in the form of progress meetings or RFI processes. The RFI process engages the design team to interact with contractors to discuss and develop solutions. However, in the absence of the RFI process or any other meaningful form of communication with the design team, contractors

Figure 3. A thermoplastic polyolefin–clad parapet wall transition to exterior insulation and finish system condition.

may take it upon themselves to resolve unique building conditions. In some circumstances, this strategy may be acceptable; however, in other cases, it may lead to building enclosure problems, either during construction or in the future, because there is a lack of clarity about who is doing what and why.

The following section presents examples of situations when a lack of mock-ups, preinstallation meetings, or RFI process resulted in constructed conditions that will be a long-term hindrance to roof maintenance and increase the difficulty of roofing material removal and replacement at these conditions.

FIELD OBSERVATIONS

The following illustrate actual field conditions encountered as part of building enclosure observations. In some instances, the descriptions for a particular condition are applicable to multiple figures. These conditions are curious and raise questions as to how and why they arose. In particular, the following should be noted:

- In **Fig. 2** and **3**, the roofing terminations are concealed from view behind exterior wall veneers, are inaccessible, and cannot be inspected without removing the veneer materials. These conditions also lack fixed sheet metal receiver trim and removable counterflashings necessary to maintain access to roofing terminations. It is the opinion of this author that building veneer materials should be held at a minimum 8 in. (200 mm) above and away from the backside of the parapet wall, per National Roofing Contractors Association (NRCA) minimum flashing height recommendations.[5]
- In **Fig. 4** and **5**, the close proximity of the vertical leg of the sheet metal receiver trim or raw edge of the sheet metal counterflashing

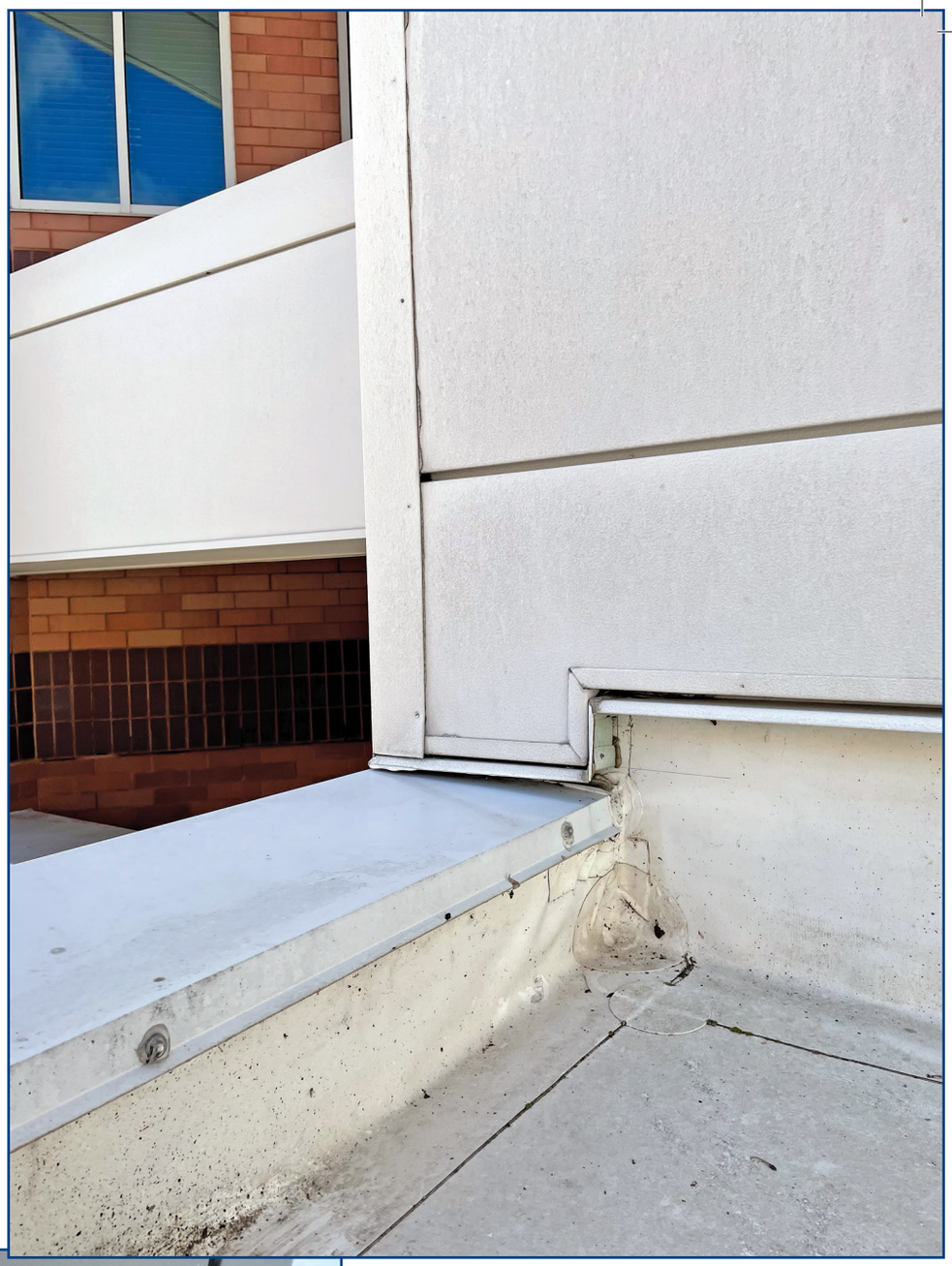

Figure 5. A thermoplastic polyolefin–clad parapet wall transition to exterior insulation and finish system condition.

Figure 4. A thermoplastic polyolefin–clad parapet wall transition to an aluminum composite material condition.

Figure 6. A thermoplastic polyolefin–clad parapet wall transition to exterior insulation and finish system condition.

Figure 7. A thermoplastic polyolefin–clad parapet wall transition to exterior insulation and finish system condition.

piece to the thermoplastic polyolefin (TPO) roof membrane flashing sheet is problematic. If any portion of these sheet metal fabrications comes into contact with the parapet wall, this would increase the potential for the roof flashing sheet to be compromised or, in a worst-case scenario, cut, providing a direct path for water leakage into the exterior wall, the roof assembly, or both.

- In **Fig. 6** and **7**, the exterior insulation and finish system (EIFS) sill-height elevations at roof-to-wall transitions are at a lower elevation than the top of the parapet wall. This results in a unique flashing condition of the inside corner where the parapet wall terminates perpendicular into the higher wall. It is this author's opinion that the sheet metal fabrication elevation should be established at a minimum NRCA-recommended flashing height of 8 in. (200 mm) above the top of the parapet wall, with that elevation held at a constant around the perimeter of that roof area.[5]
- In **Fig. 8** and **9**, brick was laid across the top of the parapet wall and rests directly onto the white TPO flashing membrane without a steel lintel to support the brick. In addition to the roofing terminations being concealed from view or inspection, the brick will impose a load on the TPO flashing sheet, which

ultimately may result in failure of that flashing sheet.

- In **Fig. 10** and **11**, the top of the parapet wall is at a slightly higher elevation than the sill height of the aluminum curtainwall frame. To address this condition, the construction manager and subcontractors held a field coordination meeting and implemented an alternative solution that introduced an overflow scupper or stepdown in the parapet wall to simplify and accommodate the transition to the aluminum curtainwall frame.
- In **Fig. 12**, the stone cap profile at the inside exterior wall corner condition was carried through to the backside of the parapet wall, resulting in an unusual condition where the stone cap and sheet

Figure 8. A thermoplastic polyolefin–clad parapet wall transition to exterior face brick veneer condition.

Figure 9. A thermoplastic polyolefin–clad parapet wall transition to exterior face brick veneer condition.

Figure 10. A thermoplastic polyolefin–clad parapet wall transition to aluminum curtainwall sill condition.

Figure 11. A thermoplastic polyolefin–clad parapet wall transition to aluminum curtainwall sill condition.

Figure 12. An inside corner of a parapet wall clad with white ethylene propylene diene terpolymer to stone and sheet metal coping termination detail condition.

metal coping awkwardly meet and the air cavity associated with the exterior wall assembly was exposed. The vertical leg of the stone coping profile at the inside corner condition should have been eliminated and a detail developed for contractor use. The contractor ultimately ended up installing a silicone-coated, precompressed expansion joint to seal off the open gaps.

For any of these conditions, what does the future reroofing scope of work look like? Will the scope of work require contractors to access existing roofing terminations by removing, storing, and reconstructing brickwork to accommodate access to the roofing terminations? Will the scope of work require replacement of aluminum composite material and EIFS damaged as a result of accessing the roofing terminations?

In either case, color matching of veneers after long-term ultraviolet exposure and weathering may be difficult even if color fade is minimal. Perhaps an "easier" choice will be made, in which existing roofing terminations concealed by building veneers are simply abandoned in place and new terminations are created as close as possible to the face of the building veneer. Would a roofing manufacturer provide a warranty for those terminations? Time will tell.

From a finish-grade perspective, some designers contend that they do not want to see roof membrane flashings above the top of the parapet wall. They prefer the look where the building veneer materials "scoot" right across the top of the parapet at transitions, which can be seen in these figures. The design of these locations may look appealing from finish grade, but the conditions created are impractical for maintaining access to roofing terminations for maintenance purposes or accommodating proper reroofing in the future without disruption to installed veneer systems.

The field examples presented in this paper underscore the importance of an interactive process between the design team and contractors, the contractor RFI process, mock-up reviews, and preinstallation meetings, especially when building enclosure conditions and terminations are atypical. In the absence of these processes, there is elevated risk that individual trades may make decisions that they believe to be in the best interest of the building owner without fully understanding the ramifications of their decisions for future building material maintenance and replacement.

CONCLUSION

Effective use of construction administration tools such as mock-ups and preinstallation meetings can go a long way toward ensuring that each trade will properly execute their scope of work, with the goals being to maintain vertical flashing heights and maintain access to roofing termination details to minimize future disruption to building material veneers when roofing materials require repair or replacement. The ultimate objective in this process is to ensure strong designer–contractor team communication so that we can all act to the best of our ability to achieve a well-crafted and detailed outcome that performs in the owner's best interest. IIBEC

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