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# LEAKING ENVELOPES

BY MICHAEL T. KUBAL

**W**ater penetration through building envelopes continues to be the number one source of complaints and related lawsuits from building owners. Yet, so little progress seems to be made to adequately address long-term solutions. Fortunately, many roof consultants are realizing that their opportunities for assisting clients go well beyond just roofs and now incorporate the entire building envelope into their practice. In fact, building envelope consultants have become an increasingly common professional offering throughout the United States and Canada in the last few years.

These professionals have recognized that, despite continuous advancements in roofing, waterproofing, and envelope systems, when incorporated into the composite envelope, buildings still leak!

This is most often caused by the individual components not being adequately detailed to allow the envelope to function as a cohesive unit. It is not the actual waterproofing materials or individual components that leak, but the junctures and terminations of these individual components.

It is said that ninety percent of all water intrusion problems occur within 1 percent of the total building exterior surface area.<sup>1</sup> That 1% comprises the various details that cover the necessary junctures and terminations of individual components. Too often, items are specified or installed without adequate thought to how they will affect envelope performance and act cohesively with other envelope components. For example, everyone recognizes that all exposed rooftop mechanical equipment must in itself be watertight, but few designers and specifiers give recognition to the critical connections and transitions attaching the equipment to the building envelope. These also must be waterproof but often end up supporting the 90%/1% principle mentioned above.

Little thought is given to the performance of these transitions

and terminations during weathering, movement, and life cycling. This results in leakage and damage that could be prevented by proper design, installation, and maintenance. However, since the 90%/1% principle seldom seems to be properly addressed by design professionals, roofing and envelope consultants are beginning to offer services in early participation of project design and construction to prevent reoccurrence of the 90%/1% principle.

Consultants are now taking an active role in supporting "verification of the envelope barrier," first by ensuring the proper detailing for terminations and transitions is provided in the construction documents. Secondly, they encourage and participate in barrier review meetings at the actual jobsites, assisting trade contractors in recognizing their role in completing a weather-tight envelope. This is accomplished by reviewing the various exterior wall details, following the systems that comprise the envelope barrier, and verifying that the transition and termination detailing is sufficiently understood by all parties involved.

*Figure 1* shows a simplified wall detail and the notes that might be made during such a barrier review meeting. Note in this figure that the roofing membrane transitions into the parapet waterproofing by the use of a counterflashing at the parapet wall. The parapet waterproofing then transitions into the facade masonry by terminating into the coping cap, and so forth.

The issues to cover in such a meeting include:

- Reviewing all building facade components.
- Reviewing the roofing and waterproofing systems to be incorporated into the envelope.
- Following the envelope barrier system's front line to ensure complete continuity.
- Reviewing all termination details for adequate watertightness.
- Reviewing all transitions between envelope components to ensure effectiveness and compatibility.

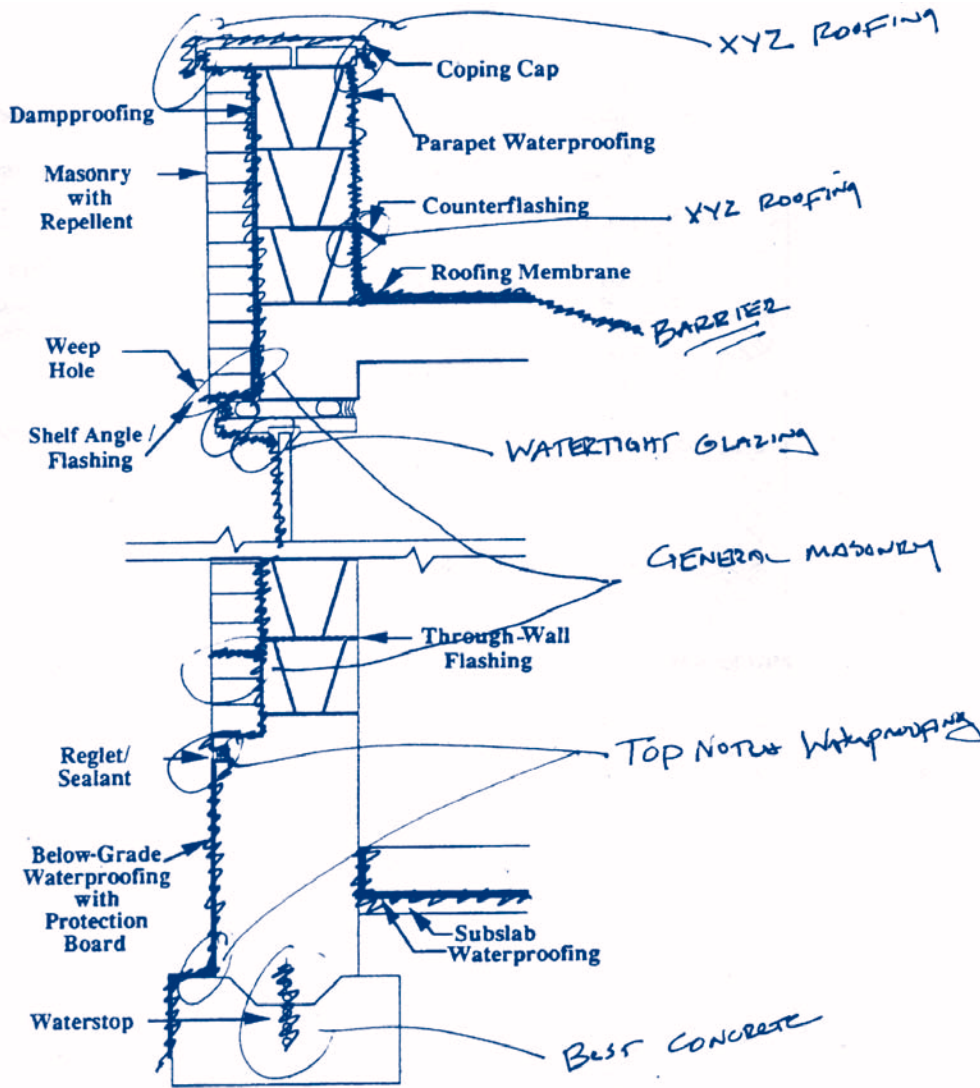


Figure 1

- Instructing all attendees on awareness of the 90%/1% concept.
- Assigning direct responsibility for each termination and transition detail.

As with all other envelope areas, leakage through roofs is typically located within 1 percent of the entire surface area, most often occurring at termination and transition detailing. This often occurs at the equipment supports, equipment pads, plumbing stacks, scuppers, drains, skylights, and lighting and electrical equipment. Detailing transitions properly and providing differential movement capability at these areas ensure watertight transitions to roofing materials and systems.

Another phenomenon which is probably more easily recognized by professionals is the "99% Principle:" Approximately 99 percent of envelope leakage is attributable to causes other than material or system failures.<sup>2</sup>

Consider the millions of squares of roofing material, miles of sealants and glazing, as well as other commonly-used facade components such as masonry. Rarely is leakage through the envelope attributable directly to failure of these materials themselves, but rather other typical mistakes such as human installa-

tion errors, the wrong system being specified for in-place service requirement (e.g., thermal movement encountered exceeds the material's capability), the wrong or no primer being used, inadequate preparatory work, incompatible materials being transitioned together, and insufficient—or in certain cases such as sealants, too much—material being applied.

These two phenomena of waterproofing work in unison to represent the overall majority of problems encountered in building envelopes. By considering these two concepts together, it can be expected that 1 percent of a building's exterior area will typically involve actual and direct leakage and that the cause will have a 99 percent chance of being anything but material failure.<sup>3</sup>

This second principle requires that the building envelope consultant take an active role throughout the construction process in order to prevent the common reoccurrences that contribute to the continuation of these two principles. Only by carefully monitoring the installation practices of envelope barrier systems can the leakage attributable to these observances be prevented.

Successful building envelopes include most if not all of the following features:

- Few protrusions and penetrations on exposed envelope portions
- Minimal number of different cladding and waterproofing systems to limit termination and transition detailing and crafts involved
- Minimal reliance on sealant systems for termination and transition detailing
- Joints designed to shed water
- Minimal reliance on single-barrier, water repellent systems and greater emphasis on designs that incorporate back-up or secondary systems
- Secondary systems installed where practicable, including:
  - ◆ Flashing
  - ◆ Dampproofing
  - ◆ Weeps
  - ◆ Drainage tubes
- Proper allowance for thermal expansion, contraction, and weathering cycles
- Absence of level or horizontal envelope areas that would allow ponding water on roofs, balconies, or walkways
- Drainage of water away from an envelope as quickly as possible, both above and below-grade, with gutters, drains, slopes, and drainage mats used where appropriate

- Recessing windows and curtain walls at slab edges
- Adequate space provided to detail all termination and transition details properly
- Preconstruction and envelope review meetings with all trades, manufacturers, and supervision that will affect envelope performance involved
- Testing and review of detailing where necessary to ensure effectiveness before construction begins
- Joint and several warranties for envelope components
- Quality-control procedures during construction
- No substitution of materials or systems after approvals, testing, and reviews
- Proper envelope maintenance by the owner during life cycling.

Roofing and building envelope consultants must be vigilant in highlighting to designers, contractors, and owners that successful completion of building envelopes goes beyond selection and application of any single envelope component. Only if all individual components of a building's envelope have adequate transitions with one another will a building remain watertight and weathertight. ■

## References

1. Kubal, Michael T., *Waterproofing the Building Envelope*, McGraw-Hill
2. Kubal, Michael T., *Construction Waterproofing Manual*, McGraw-Hill
3. Ibid.

## ABOUT THE AUTHOR

**Michael T. Kubal** currently serves as the Chief Operating Officer of J.A. Jones Environmental and Construction Services Companies, headquartered in Charlotte, North Carolina. Both are subsidiaries of J.A. Jones Services Group. Kubal has over 25 years' experience in construction, acting as a project manager and construction executive on multi million-dollar building projects. He is a graduate of the University of Florida, with a masters degree in Construction Management and has consulted with national associations regarding sales and marketing programs. Kubal is a frequent speaker on technology topics for the AEC community and has served as a guest professor at universities, presenting waterproofing and restoration courses. Kubal is the author of *Building Profits in the Construction Industry*, *Waterproofing the Building Envelope*, *Engineered Quality in Construction*, and the *Construction Waterproofing Manual*, all published by McGraw Hill. His newest book, *Bricks & Clicks: A Guide for Establishing a Bilingual Marketing Program*, was recently released by the Society of Marketing Professional Services (SMPS).



**MICHAEL T. KUBAL**