The Wet Season for Paper-Faced Gypsum

By Lonnie Haughton and Colin Murphy

Gypsum board panels for roof and wall assemblies are ubiquitous in the North American construction marketplace. In 2005, U.S. manufacturers shipped a record 36 billion square feet of gypsum board, and Canadian manufacturers shipped an additional record 4 billion square feet.[1] Countless lives have been spared by the unrivalled fire-resistive performance properties of these versatile and economical panels, which are manufactured with a gypsum core and then commonly are "faced" on all sides with a layer of cellulose-based paper. Unfortunately, under certain conditions, cellulose-based materials can be utilized as a nutritious food source by mold fungi.

It has become increasingly well understood by designers and contractors (and attorneys) that the traditional paper facers of standard gypsum board panels (whether interior wallboard or exterior sheathing) can provide an ideal substrate for mold proliferation if they are allowed to become wet. It is for this reason that some manufacturers have curtailed production of paper-faced gypsum sheathing:

> "…traditional paper-faced gypsum sheathing …has significant limitations, including a lack of resistance to moisture. …If paper-faced exterior sheathing becomes wet and the project is 'closed in' without adequate drying, the paper on the face and back of the panel can provide an excellent environment for mold growth."[2]

Even though exterior gypsum sheathing is manufactured with a wax-treated, water-resistant core and is faced with water-repellent paper, the boards can become severely damaged (including potential widespread proliferation of mold fungi) by undue exposure to excess moisture during the delivery, storage, and construction phases of a new project. They also may be damaged during subsequent years of service due to deficiencies in the weather-resistive performance of the building envelope.

The simplest method for preventing mold growth on paper-faced gypsum is to just keep the boards dry before, during, and after construction; however, the prudent specifier may wish to substitute more expensive sheathing panels that do not have paper facers. Support for this position is found in leading industry publications as evidenced by the alarmingly titled article, "Avoiding the Perils of Paper-Faced Exterior Gypsum Sheathing," published by Eric K. Olson, PE, in the February 2005 issue of *Construction Specifier* magazine:

> "Practically speaking, specifiers rarely have control over the ultimate quality of workmanship or any of the factors coming into play after construction. As such, the proper selection of mold-resistant materials to provide some 'forgiveness' due to construction errors or delays is of utmost importance."

In other words, the construction specifier can lessen potential exposure to future mold litigation and better protect the building's future occupants by specifying non-paper-faced gypsum panels that are manufactured to provide improved resistance to moisture infiltration and mold infestation. Considering the enormity of recent mold litigation awards, it is clear that the increased cost for mold-resistant materials can be as economically (and socially) justifiable as the increasing levels of seismic detailing required for new structures, even when located in zones of low seismic risk.

However, if paper-faced gypsum board is specified at a project, the contractor should be aware of current industry standards for moisture protection and mold prevention:

- GA-238, "Guidelines for Prevention of Mold Growth on Gypsum Board," issued by the Gypsum Association (**www.gypsum.org**), provides basic standards for transportation, receiving, storage, handling, and application of gypsum board products and emphasizes that "GYPSUM BOARD MUST BE KEPT DRY to prevent the growth of mold."
- GA-253, "Application of Gypsum

Photo 1 - Water and mold damage on gypsum sheathing terminating at hardscape

Sheathing," requires that "Gypsum sheathing used in building construction shall be not less than 8 inches from the finish grade in fully weather- and water-protected siding systems..."

- ASTM C 1280, "Standard Specification for Application of Gypsum Sheathing," states gypsum sheathing "shall not be exposed to the elements for more than 30 days after it has been installed" and also requires that, "The exterior face paper of the sheathing shall be dry prior to application of the ...weather-resistive barrier."

Compliance with ASTM C 1280 is prescribed within Chapter 25 of the International Building Code (IBC). The companion Commentary volumes of the IBC confirm that, "With regard to weather protection, all gypsum products must be kept dry because of the deleterious effect of moisture."

Similarly, Section R701.2 of the International Residential Code states: "Products sensitive to adverse weather shall not be installed until adequate weather protection for the installation is provided. Exterior sheathing shall be dry before applying exterior cover."

In summary, building codes and industry standards require 100% weather protection of interior gypsum wallboard products. Moreover, they forbid the contractor from "closing in" paper-faced gypsum sheathing products that have become wet. Despite these requirements, we continue to witness construction during the wet season where contractors (who may be facing stiff financial penalties if their projects are delayed) simply cover damp gypsum boards and hope for the best.

Further, as seen in the accompanying photographs, another common problem for exterior gypsum sheathing is deterioration and mold growth occurring when rainwater is blown or splashes upward at the bottom edge of exterior cladding that terminates close to a finished grade or concrete hardscape or a foundation wall.

Photos 1 - 4 depict extensive mold and moisture damage at standard exterior gypsum sheathing panels due to failures by project designers and contractors to: 1) terminate the water-sensitive sheathing at least 8 inches above grade in accordance with industry standards, and 2) take other appropriate measures to protect the sheathing from windblown rain, water-splash, or standing water.

For structural or fire-resistive continuity purposes, building codes may require exterior sheathing panels to extend fully to the bottom of the framed walls, which often terminate less than 8 inches above the fin-

Photo 2 - Damage of gypsum sheathing due to water splash under siding

ished grade or concrete hardscape. At these near-grade locations, it is the responsibility of the project designer to specify a sheathing/cladding assembly that provides the minimum levels of structural, fire-resistive, and weather-resistive performance mandated by the building code.

Prior to construction, the prudent contractor will closely review the project documents to identify the designer's instructions for these basewall transitions. If the provided guidance is not consistent with recognized industry standards, then an RFI (Request for Information) should be submitted to the designer requesting clarifications and specific written directive(s) for how the contractor should proceed. Such written instructions or details may provide the contractor a great degree of legal protection from future mold and moisture damage claims.

Photo 3 - Damage of gypsum sheathing terminating at grade (earth)

In response to the RFI, the designer may elect to specify installation of a nonpaper-faced exterior gypsum panel (or a nongypsum product, such as cementboard panels) at the bottom portion of the wall. While such products may be more expensive than standard paper-faced gypsum boards, they provide greater resistance to both mold and moisture damage.

Further, the designer may wish to specify an "end cap" (a/k/a "J-mold") to be installed at the bottom edge of the gypsum boards to eliminate the potential for water uptake into the panels after extended periods of exposure. The designer also may decide to specify continuous metal flashing or perhaps a self-adhering membrane flashing at the bottom of the wall to weather protect the bottom portion of the sheathing.

We also recommend sealing the underside of the wood sole plate (or steel channel) with a foam polyethylene or EPDM membrane, creating an air and water seal by filling any undulations between the concrete surface and the bottom of the framed wall. Sill sealers are inexpensive and highly effective. Good design should include a seal at all sill-to-concrete transitions.

The photographs dramatically demonstrate the damage that can result from simple inattention by the designer or contractor to these important base wall-sheathing transitions. For the contractor, the best protection is awareness of the potential problem and a willingness to ask the design team for guidance. There are simple steps that can be taken to form barriers, flash-

Photo 4 - Water and mold damage to gypsum sheathing terminating at hardscape

ings, and seals to minimize potential infiltration of excess moisture. Manufacturers and suppliers have met the demand by providing an array of cost-effective products that allow designers and contractors to maximize the long-term performance of conventional construction materials.

References

1. Gypsum Association
2. Georgia Pacific press release, April, 2004.

Lonnie Haughton

Lonnie Haughton is a construction consultant with Richard Avelar & Associates (www.ravelar.com), a forensic architectural consulting firm in Oakland, CA. He is one of fewer than 500 individuals nationwide who have achieved the Master Code Professional certification awarded by the International Code Council. Over the past five years, Lonnie and Colin have coauthored a wide variety of technical and building code articles for *Interface* and other construction industry publications. In October 2007, their peer-reviewed paper, "Qualitative Sampling of the Building Envelope for Water Leakage," was published by the *Journal of ASTM International.*

Colin Murphy

Colin Murphy, RRC, FRCI, is the founder and managing principal of Trinity|ERD (www.trinityerd.com), a building envelope forensics, testing, and design consulting firm based in Seattle, WA. Colin joined RCI in 1986 and became an RRC in 1993. In 1996, he was honored with the Richard M. Horowitz award for excellence in technical writing for *Interface*. In 1998, RCI granted Colin the Herbert Busching Jr. Award for significant contributions to the general betterment of the roof consulting industry. In 2001, he was named to the RCI Jury of Fellows.