

Moisture in concrete roof decks

Normal-weight and lightweight structural concrete cause some concern

by Mark S. Graham

NRCA continues to receive a significant number of reports of moisture-related problems associated with concrete roof decks. Following is some background information and NRCA's latest recommendations for addressing the issue.

What's happened

The issue of moisture in concrete roof decks is not new. Since 2009, NRCA has received numerous reports of moisture-related problems with roof systems installed on concrete roof decks—both lightweight structural and normal-weight structural concrete. Reported problems include roof system moisture accumulation, adhesion loss, adhesive issues with water-based and low-volatile organic compound adhesives, metal and fastener corrosion, insulation R-value loss and microbial growth.

Since the 2001 publication of *The NRCA Roofing and Waterproofing Manual, Fifth Edition*, NRCA no longer considers the plastic sheet test method as a viable assessment to determine a concrete roof deck's dryness before roof system application. Also, there is little to no correlation between concrete's 28-day curing period and its true "dryness."



At the September 2011 International Roofing Symposium, Rene Dupuis, president of Structural Research Inc., Middleton, Wis., and I presented a paper discussing research we had been conducting regarding newly poured structural concrete roof decks and alternative approaches for determining concrete decks' readiness (dryness) for roof system application. Based on input received from the flooring industry, we suggested an alternative approach using humidity probes drilled into concrete roof decks to assess roof decks' relative dryness. This method is described in ASTM F2170, "Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes."

In August 2013, NRCA issued an Industry Issue Update addressing moisture release in lightweight structural concrete roof decks and provided further guidance for using ASTM F2170. NRCA suggested a maximum 75 percent relative humidity (RH) value be considered as acceptable; lower values may be necessary with organic-based roofing materials, such as wood fiberboard, perlite board and reinforced cellulosic mat-faced polyisocyanurate insulation to prevent mold growth.

In the document, NRCA also recommended for the first time that designers not specify lightweight structural concrete for roof decks or as toppings for roof decks.

Also, in reroofing situations where the existing roof deck is known to be lightweight structural concrete or there is evidence of concrete deck-related moisture problems, NRCA recommended a high-bond strength vapor retarder be adhered directly to the deck followed by the installation of an adhered or loosely laid ballasted roof system.

In 2016, NRCA and the Chicago Roofing Contractors Association with contributions from the Canadian Roofing Contractors Association; GAF Materials Corp., Parsippany, N.J.; and SOPREMA® Inc., Wadsworth, Ohio, began a long-term research study with SRI Consultants on moisture release from concrete roof decks. One initial finding of this research is that 28 days and 60 days after placement, lightweight structural concrete has about half the permeability of normal-weight structural concrete. Because lightweight structural concrete arrives at a job site with considerably more evaporable water than normal-weight structural concrete, this finding helps explain why lightweight insulating concrete retains so much moisture and takes so long to adequately dry.

A second research phase is underway with additional funding being provided by Johns Manville, Denver, and The Roofing Industry Alliance for Progress. An update on this research will be presented as an educational session during the 2018 International Roofing Expo® Feb. 6-8 in New Orleans.

Moisture-related problems with concrete roof decks are not limited to lightweight structural concrete. Similar problems with normal-weight structural concrete roof decks are being reported with increased frequency to NRCA's Technical Services Section. Projects with construction schedules that do not allow structural concrete roof decks to adequately dry before roof system installation are particularly problematic.

NRCA's recommendations

NRCA maintains its earlier recommendation that designers not specify lightweight structural concrete for roof decks or as toppings for roof decks because the risks of moisture-related problems associated with lightweight structural concrete outweigh the possible benefits.

NRCA also maintains its earlier recommendation that ASTM F2170 humidity probe testing is the most reliable indicator of a concrete roof deck's dryness. The maximum 75 percent RH value (lower for some roofing material types) has proved to be a successful threshold for assessing a structural concrete deck's dryness. Both ASTM F2170 testing and the 75 percent RH threshold now are suggested for newly placed normal-weight structural concrete roof decks.

In reroofing situations where the existing roof deck is known to be lightweight structural concrete or there is evidence of concrete deck-related moisture problems, NRCA maintains its earlier recommendation for using a high-bond strength vapor retarder adhered directly to the roof deck. Roof system designs using mechanical fasteners penetrating a vapor retarder should be avoided.

NRCA also now suggests designers implement these vapor retarder recommendations over newly placed normal-weight structural concrete roof decks, as well.

Additional information about concrete roof decks is contained in Chapter 2—Roof Decks of The NRCA Roofing Manual: Membrane Roof Systems, which is available as a free download for NRCA members at shop.nrca.net.

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The National Roofing Legal Resource Center's (NRLRC's) Contract Provisions Volume I and III contain draft proposal, contract and deck acceptance language roofing contractors can use to clarify their responsibilities for roof deck issues. NRLRC documents can be accessed at shop.nrca.net.

ICC and NAHB offer TechNotes series to assist builders

The International Code Council (ICC) and ICC Evaluation Service have partnered with the National Association of Home Builders (NAHB) to distribute a TechNotes series developed by NAHB's Construction Technology Research Subcommittee and Innovation Research Lab.

The TechNotes series is designed to help builders understand and apply the most recent code requirements, as well as implement best practices to avoid building-performance issues related to interior humidity levels, condensation in wall and roof assemblies, and interior air quality.

"NAHB has worked diligently in creating these TechNotes, and we are confident these consolidated and simplified guidelines will be beneficial to both home builders and building officials in creating safe and affordable homes," says Chip Dence, chairman of NAHB's Construction Codes and Standards Committee.

The TechNotes series will continue to expand and include new topics. The following topics currently are available: whole house mechanical ventilation, building air tightness, floors above crawlspaces, rain and groundwater, window and door flashing, vapor retarders and supplemental dehumidification.

The TechNotes series is available free of charge at www.iccsafe.org/TechNotes and www.nahb.org.

ASTM International announces award recipients

ASTM International has announced Michael J. Noone, former vice president of CertainTeed Corp., Malvern, Pa., has received the William C. Cullen Award from ASTM International's Committee D08 on Roofing and Waterproofing, and Errol D. Bull, technical manager for Momentive Performance Materials, Waterford, N.Y., has received the Lou Toporcer Hall of Fame Award from ASTM International's Committee C24 on Building Seals and Sealants.



Noone



Bull

ASTM International's Committee D08 on Roofing and Waterproofing established the William C. Cullen Award to recognize members who demonstrate outstanding contributions and personal commitment to the field. Noone was honored for his dedication and contributions to the roofing and waterproofing industry, particularly in the asphalt shingle segment. A member of ASTM International's Committee D08 since 1979, he previously received the Award of Merit in 1997.

The Lou Toporcer Hall of Fame Award was established in 1972 and recognizes individuals who have demonstrated distinguished service and contributions to the building seals and sealants industry. An ASTM International member since 2000, Bull was recognized for his service in voluntary standardization. He previously received the Award of Appreciation in 2003 and 2007 from ASTM International's Committee C24 on Building Seals and Sealants.

MCA introduces certification program for metal roofing products

The Metal Construction Association (MCA) has introduced its Metal Roofing Certification Program for metal roofing products.

The program's goal is to help companies differentiate their products by earning certification based on industry standards published in MCA's Metal Roofing Systems Performance Guide Specification. The certification label is intended to help contractors and consumers identify quality steep-slope metal roofing products. Products that meet the certification criteria may be promoted as "Metal Construction Association Certified Premium Painted,™" "Metal Construction Association Certified Standard Painted™" or "Metal Construction Association Certified Natural.™"

For additional information, visit www.metalconstruction.org/metal-roof-cert.

NRCA update

In June, NRCA Technical Services staff traveled to the ASHRAE Annual Conference in Long Beach, Calif.

During the conference, staff attended ASHRAE's SSPC 90.1 committee meetings. SSPC 90.1 is responsible for ASHRAE Standard 90.1, "Energy Standard for Buildings Except Low-Rise Residential Buildings." Jason Wilen, an NRCA technical director, was reappointed as NRCA's primary organizational representative and will remain a voting member of the building envelope subcommittee through 2019.

Staff also attended ASHRAE's SSPC 189.1 committee meetings. SSPC 189.1 is responsible for ASHRAE Standard 189.1, "Standard for the Design of High-Performance Green Buildings Except Low-Rise Residential Buildings." Wilen was named a voting member of the 189.1 committee through 2021 and appointed the new chairman of Work Group 10: Construction and Plans for Operation.

Future ASHRAE committee meetings include ASHRAE 90.1 in October at ASHRAE's headquarters in Atlanta and ASHRAE 189.1 during ASHRAE's 2018 Winter Conference in Chicago Jan. 20-24.