NRLRC
National Roofing Legal Resource Center

2015 Annual NRLRC Luncheon Program

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Part 2: Observations from the field: Legal do's and don'ts

Presented by

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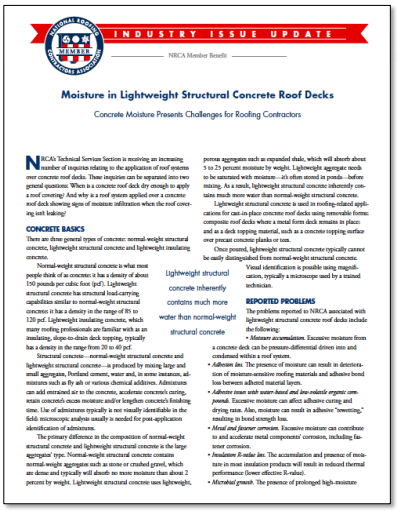
Concrete deck issues



INDUSTRY ISSUE UPDATE

NRCA Member Benefit

Moisture in Lightweight Structural Concrete Roof Decks

Concrete Moisture Presents Challenges for Roofing Contractors

NRCA's Technical Services Section is receiving an increasing number of inquiries relating to the application of roof systems over concrete roof decks. These inquiries can be separated into two general questions: When is a concrete roof deck dry enough to apply a roof covering? And why is a roof system applied over a concrete roof deck showing signs of moisture infiltration when the roof covering isn't leaking?

CONCRETE BASICS

There are three general types of concrete: normal-weight structural concrete, lightweight structural concrete and lightweight insulating concrete.

Normal-weight structural concrete is what most people think of as concrete; it has a density of about 150 pounds per cubic foot (pcf). Lightweight structural concrete has structural load-carrying capabilities similar to normal-weight structural concrete; it has a density in the range of 85 to 120 pcf. Lightweight insulating concrete, which many roofing professionals are familiar with as an insulating, slope-to-drain deck topping, typically has a density in the range from 20 to 40 pcf.

Structural concrete—normal-weight structural concrete and lightweight structural concrete—is produced by mixing large and small aggregates, Portland cement, water and, in some instances, admixtures such as fly ash or various chemical additives. Admixtures can add entrained air to the concrete, accelerate concrete's curing, retain concrete's excess moisture and/or lengthen concrete's finishing time. Use of admixtures typically is not visually identifiable in the field; microscopic analysis usually is needed for post-application identification of admixtures.

The primary difference in the composition of normal-weight structural concrete and lightweight structural concrete is the large aggregates' type. Normal-weight structural concrete contains normal-weight aggregates such as stone or crushed gravel, which are dense and typically will absorb no more moisture than about 2 percent by weight. Lightweight structural concrete uses lightweight, porous aggregates such as expanded shale, which will absorb about 5 to 25 percent moisture by weight. Lightweight aggregate needs to be saturated with moisture—it's often stored in ponds—before mixing. As a result, lightweight structural concrete inherently contains much more water than normal-weight structural concrete.

Lightweight structural concrete is used in roofing-related applications for cast-in-place concrete roof decks using removable forms; composite roof decks where a metal form deck remains in place; and as a deck topping material, such as a concrete topping surface over precast concrete planks or tees.

Once poured, lightweight structural concrete typically cannot be easily distinguished from normal-weight structural concrete. Visual identification is possible using magnification, typically a microscope used by a trained technician.

Lightweight structural concrete inherently contains much more water than normal-weight structural concrete

REPORTED PROBLEMS

The problems reported to NRCA associated with lightweight structural concrete roof decks include the following:

- *Moisture accumulation.* Excessive moisture from a concrete deck can be pressure-differential driven into and condensed within a roof system.
- *Adhesion loss.* The presence of moisture can result in deterioration of moisture-sensitive roofing materials and adhesive bond loss between adhered material layers.
- *Adhesive issues with water-based and low-volatile organic compound.* Excessive moisture can affect adhesive curing and drying rates. Also, moisture can result in adhesive "sweetning," resulting in bond strength loss.
- *Metal and fastener corrosion.* Excessive moisture can contribute to and accelerate metal components' corrosion, including fastener corrosion.
- *Insulation R-value loss.* The accumulation and presence of moisture in most insulation products will result in reduced thermal performance (lower effective R-value).
- *Microbial growth.* The presence of prolonged high-moisture

- Dry times:
  - Normal weight: Less than 90 days
  - Lightweight: About 6 months
- Roofing contractors should not make "when to roof" decision

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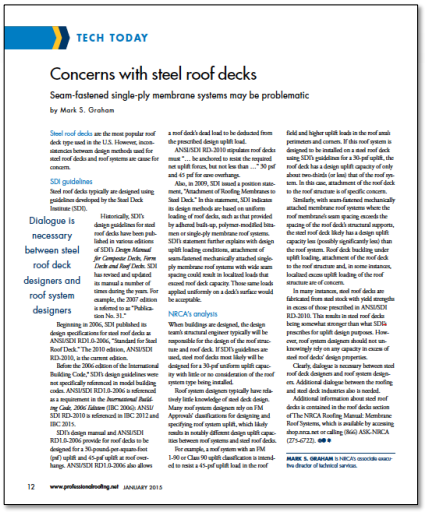
Steel deck issues



TECH TODAY

Concerns with steel roof decks

Seam-fastened single-ply membrane systems may be problematic

by Mark S. Graham

Steel roof decks are the most popular roof deck type used in the U.S. However, inconsistencies between design methods used for steel roof decks and roof systems are cause for concern.

SDI guidelines

Steel roof decks typically are designed using guidelines developed by the Steel Deck Institute (SDI).

Historically, SDI's design guidelines for steel roof decks have been published in various editions of SDI's *Design Manual for Composite Decks, Form Decks and Roof Decks*. SDI has revised and updated its manual a number of times during the years. For example, the 2007 edition is referred to as "Publication No. 31."

Beginning in 2006, SDI published its design specifications for steel roof decks as ANSI/SDI RDI-S-2006, "Standard for Steel Roof Deck." The 2010 edition, ANSI/SDI RD-2010, is the current edition.

Before the 2006 edition of the International Building Code," SDI's design guidelines were not specifically referenced in model building codes. ANSI/SDI RDI-S-2006 is referenced as a requirement in the *International Building Code, 2006 Edition* (IBC 2006). ANSI/SDI RD-2010 is referenced in IBC 2012 and IBC 2015.

SDI's design manual and ANSI/SDI RDI-S-2006 provide for roof decks to be designed for a 30-pound-per-square-foot (psf) uplift and 45-psf uplift at roof overhangs. ANSI/SDI RDI-S-2006 also allows a roof deck's dead load to be deducted from the prescribed design uplift load.

ANSI/SDI RD-2010 stipulates roof decks must "... be anchored to resist the required net uplift forces, but not less than ...." 30 psf and 45 psf for area overhangs.

Also, in 2009, SDI issued a position statement, "Attachment of Roofing Membranes to Steel Deck." In this statement, SDI indicates its design methods are based on uniform loading of roof decks, such as that provided by adhered built-up, polymer-modified bitumen or single-ply membrane roof systems. SDI's statement further explains with design uplift loading conditions, attachment of seam-fastened mechanically attached single-ply membrane roof systems with wide seam spacing could result in localized loads that exceed roof deck capacity. These same loads applied uniformly on a deck's surface would be acceptable.

NRCA's analysis

When buildings are designed, the design team's structural engineer typically will be responsible for the design of the roof structure and roof deck. If SDI's guidelines are used, steel roof decks most likely will be designed for a 30-psf uniform uplift capacity with little or no consideration of the roof system type being installed.

Roof system designers typically have relatively little knowledge of steel deck design. Many roof system designers rely on FM Approvals' classifications for designing and specifying roof system uplift, which likely results in notably different design uplift capacities between roof systems and steel roof decks.

For example, a roof system with an FM 1-90 or Class 90 uplift classification is intended to resist a 45-psf uplift load in the roof field and higher uplift loads in the roof areas perimeters and corners. If this roof system is designed to be installed on a steel roof deck using SDI's guidelines for a 30-psf uplift, the roof deck has a design uplift capacity of only about two-thirds (or less) that of the roof system. In this case, attachment of the roof deck to the roof structure is of specific concern.

Similarly, with seam-fastened mechanically attached membrane roof systems where the roof membrane's seam spacing exceeds the spacing of the roof deck's structural supports, the steel roof deck likely has a design uplift capacity less (possibly significantly less) than the roof system. Roof deck buckling under uplift loading, attachment of the roof deck to the roof structure and, in some instances, localized excess uplift loading of the roof structure are of concern.

In many instances, steel roof decks are fabricated from steel stock with yield strengths in excess of those prescribed in ANSI/SDI RD-2010. This results in steel roof decks being somewhat stronger than what SDIs prescribes for uplift design purposes. However, roof system designers should not unknowingly rely on any capacity in excess of steel roof decks' design properties.

Clearly, dialogue is necessary between steel roof deck designers and roof system designers. Additional dialogue between the roofing and steel deck industries also is needed.

Additional information about steel roof decks is contained in the roof decks section of The NRCA Roofing Manual: Membrane Roof Systems, which is available by accessing shop.nrca.net or calling (866) ASK-NRCA (275-6722). ●●●

MARK S. GRAHAM is NRCA's executive executive director of technical services.

12 www.professionalroofing.net JANUARY 2015

Dialogue is necessary between steel roof deck designers and roof system designers

- Wind uplift design:
  - Likely 30 psf
- Deck uplift design likely does not account for use of seam-fastened mechanically-attached single ply membrane systems

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Contract provisions—Deck acceptance

"Roofing Contractor's commencement of the roof installation indicates only that the Roofing Contractor has visually inspected the surface of the roof deck for visible defects and has accepted the surface of the roof deck. Roofing Contractor is not responsible for the construction, structural sufficiency, durability, fastening, moisture content, suitability, or physical properties of the roof deck or other trades' work or design. Roofing Contractor is not responsible to test or assess moisture content of the deck or substrate."

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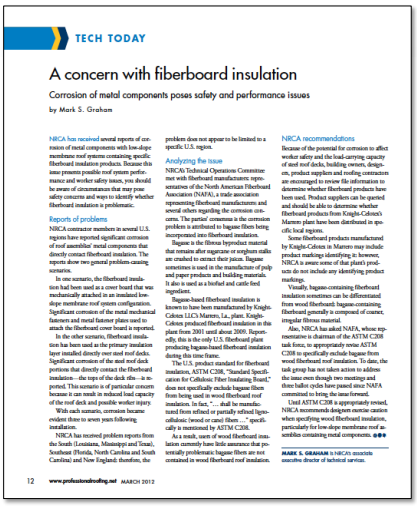
Fiberboard insulation



TECH TODAY

A concern with fiberboard insulation

Corrosion of metal components poses safety and performance issues

by Mark S. Graham

NRCA has received several reports of corrosion of metal components with low-slope membrane roof systems containing specific fiberboard insulation products. Because this issue presents possible roof system performance and worker safety issues, you should be aware of circumstances that may pose safety concerns and ways to identify whether fiberboard insulation is problematic.

Reports of problems

NRCA contractor members in several U.S. regions have reported significant corrosion of roof assemblies' metal components that directly contact fiberboard insulation. The reports show two general problem-causing scenarios.

In one scenario, the fiberboard insulation had been used as a cover board that was mechanically attached in an insulated low-slope membrane roof system configuration. Significant corrosion of the metal mechanical fasteners and metal fastener plates used to attach the fiberboard cover board is reported.

In the other scenario, fiberboard insulation has been used as the primary insulation layer installed directly over steel roof decks. Significant corrosion of the steel roof deck portions that directly contact the fiberboard insulation—the tops of the deck ribs—is reported. This scenario is of particular concern because it can result in reduced load capacity of the roof deck and possible worker injury.

With each scenario, corrosion became evident three to seven years following installation.

NRCA has received problem reports from the South (Louisiana, Mississippi and Texas), Southeast (Florida, North Carolina and South Carolina) and New England; therefore, the problem does not appear to be limited to a specific U.S. region.

Analyzing the issue

NRCA's Technical Operations Committee met with fiberboard manufacturers' representatives of the North American Fiberboard Association (NAFA), a trade association representing fiberboard manufacturers; and several others regarding the corrosion concerns. The parties' consensus is the corrosion problem is attributed to bagasse fibers being incorporated into fiberboard insulation.

Bagasse is the fibrous byproduct material that remains after sugarcane or sorghum stalks are crushed to extract their juices. Bagasse sometimes is used in the manufacture of pulp and paper products and building materials. It also is used as a biofuel and cattle feed ingredient.

Bagasse-based fiberboard insulation is known to have been manufactured by Knight-Celotex LLC's Marrero, La., plant. Knight-Celotex produced fiberboard insulation in this plant from 2001 until about 2000. Reportedly, this is the only U.S. fiberboard plant producing bagasse-based fiberboard insulation during this time frame.

The U.S. product standard for fiberboard insulation, ASTM C208, "Standard Specification for Cellulosic Fiber Insulating Board," does not specifically exclude bagasse fibers from being used in wood fiberboard roof insulation. In fact, "... shall be manufactured from refined or partially refined lignocellulosic (wood or cane) fibers ..." specifically is mentioned by ASTM C208.

As a result, users of wood fiberboard insulation currently have little assurance that potentially problematic bagasse fibers are not contained in wood fiberboard roof insulation.

NRCA recommendations

Because of the potential for corrosion to affect worker safety and the load-carrying capacity of steel roof decks, building owners, designers, product suppliers and roofing contractors are encouraged to review this information to determine whether fiberboard products have been used. Product suppliers can be queried and should be able to determine whether fiberboard products from Knight-Celotex's Marrero plant have been distributed in specific local regions.

Some fiberboard products manufactured by Knight-Celotex in Marrero may include product markings identifying it; however, NRCA is aware some of that plant's products do not include any identifying product markings.

Visually, bagasse-containing fiberboard insulation sometimes can be differentiated from wood fiberboard: bagasse-containing fiberboard generally is composed of coarser, irregular fibrous material.

Also, NRCA has asked NAFA, whose representative is chairman of the ASTM C208 task force, to appropriately revise ASTM C208 to specifically exclude bagasse from wood fiberboard roof insulation. To date, the task group has not taken action to address the issue even though two meetings and three ballot cycles have passed since NAFA committed to bring the issue forward.

Until ASTM C208 is appropriately revised, NRCA recommends designers exercise caution when specifying wood fiberboard insulation, particularly for low-slope membrane roof assemblies containing metal components. ◆◆◆

MARK S. GRAHAM is NRCA's executive director of technical services.

12 www.professionalroofing.net MARCH 2012

- Steel deck and fastener corrosion associated with bagasse-based fiberboard
- Knight-Celotex product manufactured in Marrero, LA

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Recent calls to NRCA Technical Services

- Water-based and LVOC adhesive issues
- Aged, 45-mil TPO issues
- Manufacturing issues to single-ply accessories
- Board joint ridging with fiber-reinforced gypsum board
- Blistering with asphalt core board
- Manufacturer-specific MB cap sheet issues

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GAF Timberline shingle class action

- Manufacture dates:
  - 1999-2007: Mobile, AL plant
  - 1998-2009: All other GAF plants
- Objection/exclusion date:
  - March 16, 2015
- Additional information:
  - www.roofsettlement.com

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