Considerations for concrete roof decks

by **Mark S. Graham**

Q: *What is the difference between normal-weight structural concrete and lightweight concrete used for roof decks?*

A: Normal-weight structural concrete—concrete that weighs about 150 pounds per cubic foot (2400 kg/m³)—is composed principally of portland cement, coarse and fine aggregates, and water. Structural concrete's primary attribute is its high compressive strength; the proportions of structural concrete's ingredients can be tailored to develop specialized properties to suit specific project needs.



There are two types of lightweight concrete—*structural* and *insulating*—each with different properties.

Lightweight structural concrete's density is about 85 to 120 pounds per cubic foot (1360 to 1920 kg/m³). Its physical properties and composition are similar to that of normal-weight structural concrete, except relatively lightweight aggregates, such as expanded shale, clay and slate, are used instead of other coarse aggregates used in a normal-weight concrete mix.

Lightweight insulating concrete is composed principally of portland cement, either lightweight insulating aggregates (i.e., perlite, vermiculite or polystyrene beads) or an air-entraining agent (e.g., cellular concrete), and relatively large amounts of water. The compressive strength of lightweight insulating concrete is considerably lower than that of structural concrete, but its insulating properties (e.g., R-value) are higher.

Q: *How long should a newly poured structural concrete roof deck be allowed to cure and dissipate its mixing water before roof system application is appropriate?*

A: Because of the large number of concrete mix designs, weather conditions and wide variety of methods of forming, placing and curing concrete, it is difficult to establish a general rule for the recommended curing time for structural concrete decks.

Concrete mix designs and the amount of water in concrete mixes vary significantly among projects and throughout the United States.

While concrete is being poured and curing, the temperature, humidity and wind speed can greatly impact the rate of water loss from the new concrete.

Concrete forming and placement methods also affect the rate at which water will dissipate from newly poured concrete. If the concrete forms are removed shortly after the concrete has taken an initial set (a somewhat common practice), moisture will dissipate from the slab's bottom much more quickly than if the concrete forms were left in place for several weeks.

Methods of protecting and curing the top of newly poured concrete also will affect the rate at which water dissipates from the concrete. For example, if a polyethylene film or similar means is used to temporarily protect a concrete slab and assist in retaining water for concrete curing, the rate at which moisture will dissipate from the concrete will be much slower than if no topside covering is used. Similarly, the use of a concrete curing compound typically retards the loss of moisture from concrete.

For these reasons, designers are encouraged to specify curing and drying times for concrete roofing and waterproofing substrates that are appropriate for the concrete mix design, climatic and environmental conditions and specific work practices of the particular project.

Q: The NRCA Roofing and Waterproofing Manual *and some manufacturers' product literature state that certain concrete-curing compounds are incompatible with some roofing materials. What is the nature of this incompatibility, and how do I ensure compatibility with the particular roof system I am installing?*

A: Concrete curing compounds sometimes are used over newly poured concrete surfaces to aid the curing process. Curing compounds generally are intended to assist in retaining moisture (water) in the concrete mix until the portland cement's hydration is complete.

The primary concern relating to roofing and waterproofing systems is that certain concrete-curing compounds develop a wax-like seal or oily coating on the concrete's surface that can prevent bitumen and adhesives from adequately adhering to the substrate.

With certain curing compounds, there also is a potential for chemical incompatibility between the curing compound and some of the materials used in roofing and waterproofing systems.

On newly placed concrete where roofing or waterproofing materials will be installed, designers are encouraged to closely evaluate the necessity of a curing compound. If a curing compound is necessary, the designer should verify the curing compound's compatibility with the particular roofing or waterproofing materials specified. The manufacturer of the concrete-curing compound should be able to provide information regarding compatibility of materials, as should the roofing or waterproofing materials' manufacturer. PR

Each month in this column, Terrance R. Simmons, RRC, or Mark S. Graham, both NRCA deputy directors of technology and research, will answer readers' technical questions. If you have a specific question that you would like answered in this column, send it to Professional Roofing, *10255 W. Higgins Road, Suite 600, Rosemont, Ill. 60018-5607; or fax (708) 299-1183.*