

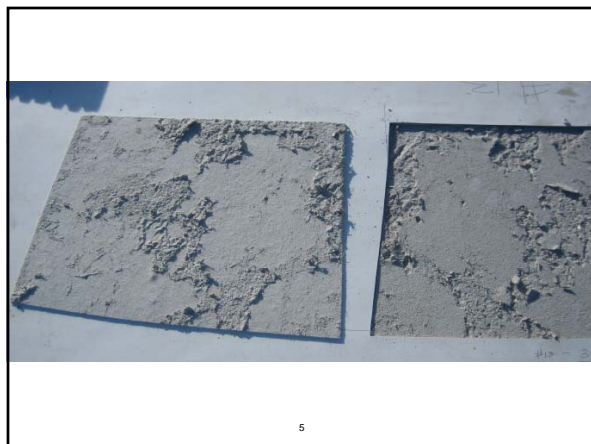
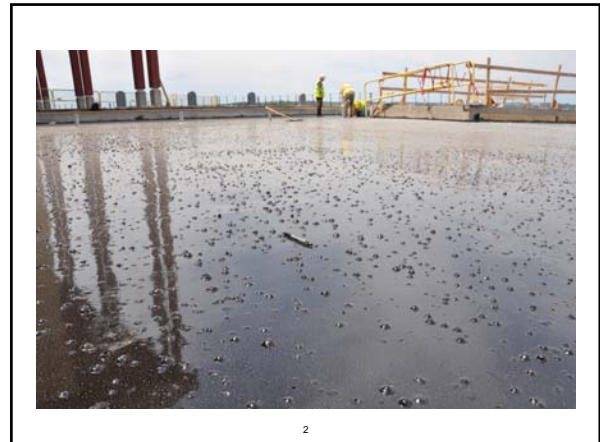
Roofing Issues: Decks to Dockets
September 19-21, 2013 – Carlsbad, CA

**Problems and Risks Posed
by Concrete Roof Decks**

presented by



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Some terminology



- **Structural concrete (normal weight)**
– 150 lbs/ft³
- **Lightweight structural concrete**
– 85–120 lbs/ft³
- **Lightweight insulating concrete**
– 20–40 lbs/ft³



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Concrete mix design

- Aggregate:
 - Large aggregate
 - Fine (small) aggregate
- Portland cement
- Water
- Admixtures:
 - Fly ash
 - Air entrainment
 - Curing compounds
 - Etc.






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Concrete Aggregates
60-80% of Concrete Mix Design



- Normal-weight aggregates (stone):
 - Dense
 - Absorb about 2% by weight
- Light-weight aggregates (expanded shale):
 - Porous
 - Absorbs from 5 - 25% by weight

**Lightweight structural concrete
inherently contains more moisture**

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An up-close look


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Uses for lightweight structural concrete

- Cast-in-place roof decks (removable forms)
- Composite roof decks (metal form deck stays in-place)
- Deck topping (e.g., topping over precast concrete)



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What is the appeal?



Water Tower Place (1975)
Chicago, IL
859 feet tall



- Reduced weight:
 - Transportation
 - Pumping
 - Placement
 - In-place (Dead load)
- Similar strength
- Similar workability:
 - Begin finishing earlier
- Sustainability credit:
 - LEED

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Reported roofing-related problems

- Moisture within the roof system
- Loss of adhesion
- Insulation facer delamination
- Adhesive curing issues
- Mold growth
- Fastener/metal corrosion
- R-value loss



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When is it OK to roof?

Historical guidelines

- After 28 days
- Application of hot bitumen
- Plastic film test
 - ASTM D4263, “Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method”



These are not appropriate for current generations of concrete mixes


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Flooring industry

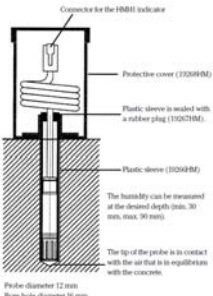

ASTM Committee F06—Resilient Floor Coverings



- ASTM F1869, “Standard Test Method for Measuring Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride”
- ASTM F2170, “Standard Test Method for Determining Humidity in Concrete Floor Slabs Using In-situ Probes”


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ASTM F2170 apparatus

Measure relative humidity (RH %) and temperature




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Trial ASTM F2170 tests

Existing lightweight structural concrete roof decks

	Roof 1	Roof 2	Roof 3
Roof age (yrs)	4	7	7
Area (ft ²)	13,200	23,840	14,760
Thickness (in.)	6.5	7.5	7.3
No. of readings	13	10	8
High reading	99% RH	99% RH	99% RH
Low reading	63% RH	96% RH	84% RH
Median reading	97% RH	99% RH	99% RH
Mean reading	89% RH	99% RH	95% RH

Values of 65-85% RH are considered acceptable in the flooring industry depending upon the specific floor covering type.




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Concrete Floors and Moisture, 2nd Edition

Howard M. Kanare, CTL Group



75% internal RH can be achieved:

- Normal weight structural concrete
 - Less than 90 days
- Lightweight structural concrete
 - Almost 6 months


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Conclusions



- Concrete roof decks – normal weight and light-weight structural – present challenging moisture-related considerations.
- Further complicated by the use of admixtures and method of finishing.
- NRCA does not support the 28-day drying period or the plastic sheet test


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Conclusions - continued


- Roofing contractors can only visually assess the dryness of the concrete's top surface
- Roofing contractors cannot readily assess any remaining free moisture within concrete or its likely release

Roofing contractors are not privy to and may not be knowledgeable about the information necessary to make "...when to roof..." decisions

Additional information

Professional Roofing, Feb. 2010 Professional Roofing, Jan. 2012





Recommendations
Normal weight structural concrete

In new construction:

- Designer should specify "...when to roof..." criteria
 - Consult with CM/GC, concrete supplier and placement contractor, and roof system manufacturer

In reroofing:



- If evidence of moisture-related problems associated with the deck, treat the deck as lightweight structural concrete

Recommendations – cont.
Lightweight structural concrete

In new construction:

- NRCA recommends lightweight structural concrete not be used for roof deck construction.
- If lightweight structural concrete is used, the Designer should specifically identify concrete drying parameters/when to apply roofing






Recommendations – cont.

Existing concrete roof decks (known to be lightweight structural concrete or where moisture-related problems are evident):

- Above-deck venting design (e.g., venting base sheet)
- Adhered vapor retarder (e.g., two-part epoxy 12-15 mils)

Adhered or loosely-laid, ballasted roof systems

NRCA Industry Issue Update, August 2013



NRLRC's Contract Provisions, Vol. III

“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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