MCTC FINDINGS

CURING CONCRETE PAVEMENTS

WHY CURE?

Properly curing concrete is critical to develop the performance properties that result in a long service life. Curing involves maintaining both proper moisture and proper temperatures to promote hydration. The primary benefits of curing are observed in the top 1-1¼ inches* of concrete, precisely the portion of the concrete directly exposed to weather and traffic loading. Curing's impact on strength is widely known; it is important to understand that curing impacts all properties of concrete including durability (permeability/resistivity), hardness (dusting), curling, warping, and early-age cracking.

Initial Curing:

- Protects surface immediately after placement
- Retards evaporation until final curing is in place
  - » Fogging (avoid ponding water on the surface)
  - » Evaporation retarders (not to be used for finishing)

Final Curing:

- Protects surface by reducing the evaporation rate for days
- Should be placed as soon as possible after finishing (30 minutes maximum is a common specification)
- Curing compound is most common
- Wet burlap and plastic sheeting may be used for smaller placements
- Curing blankets may be used when temperature protection is needed

CURING EQUIPMENT

As listed in Minnesota DOT specification, curing should be applied with fully automatic, self-propelled mechanical power sprayer equipment. The sprayer shall have a:

- Recirculating bypass system that provides for continuous agitation
- Shield to control loss of material
- Spray-bar drive system that operates independently of the track drive system

BENEFITS OF PROPER CURING

Reduced Permeability:

Reduces potential for water, chlorides, and other contaminants to penetrate concrete microstructure.

Increased Strength:

Availability of moisture extends hydration development, which contributes to higher concrete strength.

Increased Hardness:

Extended hydration increases surface hardness and improves abrasion resistance.

Reduced Shrinkage:

Protecting the surface from moisture loss reduces internal stress gradients and reduces the likelihood and severity of cracking.

Reduced Curling and Warping:

Protecting concrete from temperature gradients (curling) and moisture gradients (warping) reduces the likelihood of failure under traffic.

GOOD CURING PRACTICES

- Apply curing as soon as practical after any bleed water has dissipated.
- Cure cart should operate at consistent speed.
- Curing coverage should be even and complete.
- Pavement edge should be covered.
- Cure cart should be advanced often to keep it as close to the paver as possible.

Uniform Application with Proper Edge Coverage

MnDOT established a standard for curing that is easily understood and easily inspected.

"MnDOT Curing Specification: Apply curing compound homogeneously to provide a uniform, solid, white, opaque coverage on exposed concrete surfaces (equal to a white sheet of typing paper) at the time of application."

The MnDOT specification has been adopted by several States and is regarded as user friendly and effective.

Inadequate Application

Improper Edge Coverage

Images FHWA provided

"A key to MnDOT achieving longer life pavements has been specifying a high quality curing compound (e.g. poly-alpha methyl styrene). Requiring curing coverage equal to a white sheet of typing paper is easy for everyone to understand and enforce."

Maria Masten, Concrete Engineer,
Minnesota Department of Transporation

REFERENCES: https://www.fhwa.dot.gov/pavement/concrete/pubs/hif18015.pdf
and *Peter C Taylor, Curing Concrete, 1st Edition, CRC Press, September 10, 2013

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