Bridge Deck Cracking in Montana

I-90 Corridor

Search for Cracks: Not Hard!

I-90 Corridor

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We Have a Problem. What Did We Do?

- Visited >25 bridges in the I-90 Corridor from Missoula, MT to the Idaho Border.
- Initiated emergency contract with WJE and developed scope or work. (4 decks in detail, 8 decks cursory).
- Aided WJE in Research. (Traffic Control, Coring Services, As-Builts, Testing Data, etc.)
- Discussed recommendations with WJE and internally.
- Implemented many of the original recommendations from materials, construction, and design aspects.
  - W/CM ratio 0.42 - 0.45 (Limit Autogenous Shrinkage)
  - Limit Silica Fume Content
  - Reduce Plastic Concrete Temperatures (every degree decreased = a degree lower at peak)
  - Use of Optimized Gradation (incentivized)
  - Increased Deck Thickness
  - Required Staggering of Top and Bottom Reinforcement Mats (prevent through-holes)
  - And Most Importantly – WAIT FOR IT >>>>>>

Curing!

MDT moved from a standard 14-day wet cure to a modified wet-curing method in an attempt counteract thermal gradients at early ages.

The Rundown on our Modified Cure Spec

- **Outline**
- Before Placement
- During Placement
- Curing Sequence

New to Contractors and MDT

- Outline
- **Before Placement**
- After Placement
- Curing Sequence

Go over specs:

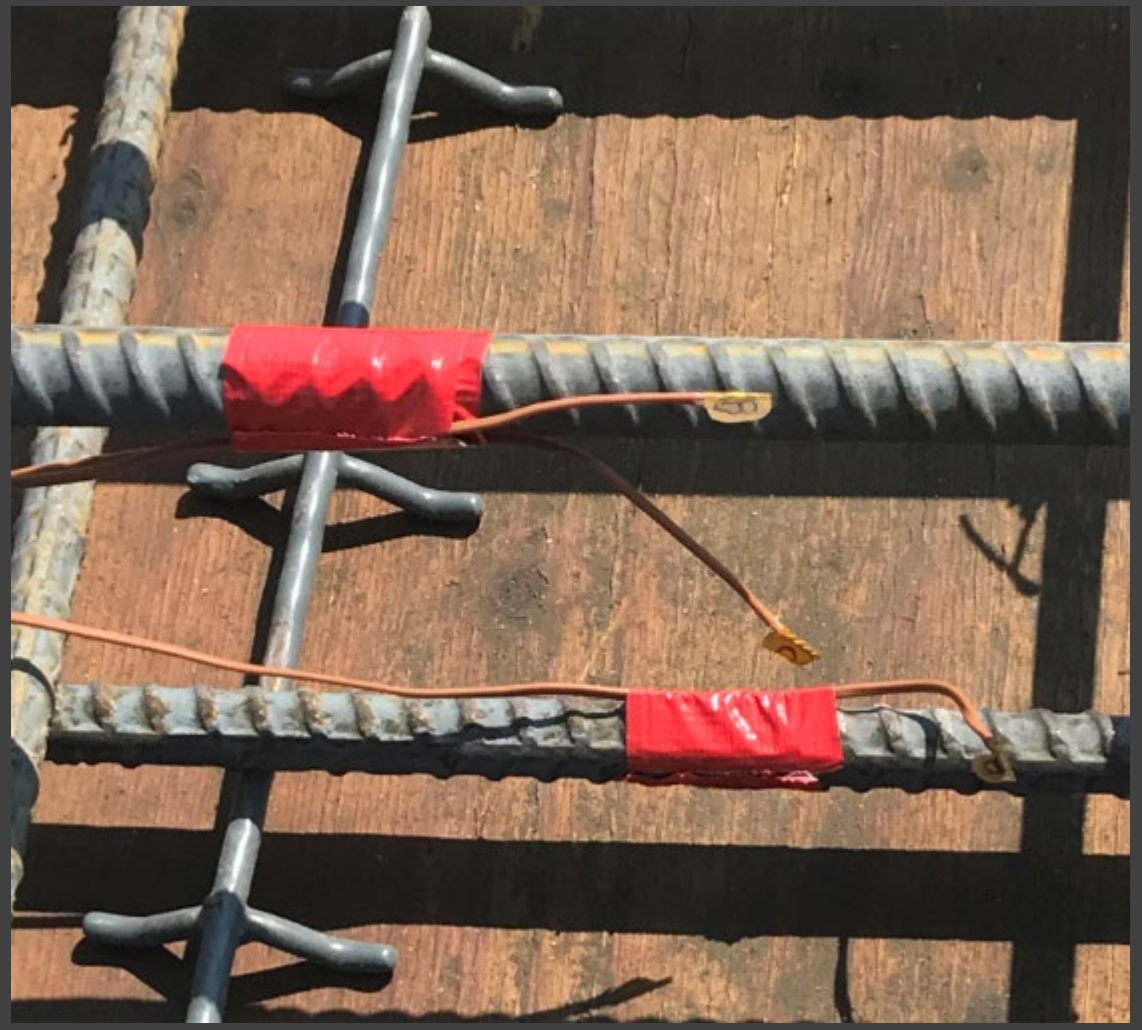
- At Preconstruction Meeting
- Again, in detail, at the Pre-Placement Meeting
- Identify which Contractor personnel will be on site to monitor temps/add plastic and blankets
- MDT also needs an inspector on site until the blankets go down.

Temperature Sensor Installation

- Outline
- **Before Placement**
- During Placement
- Curing Sequence

4 probes, placed in 3 locations, per concrete placement:

- 2’ above deck (Ambient)
- Top Mat
- Middle
- Bottom Mat



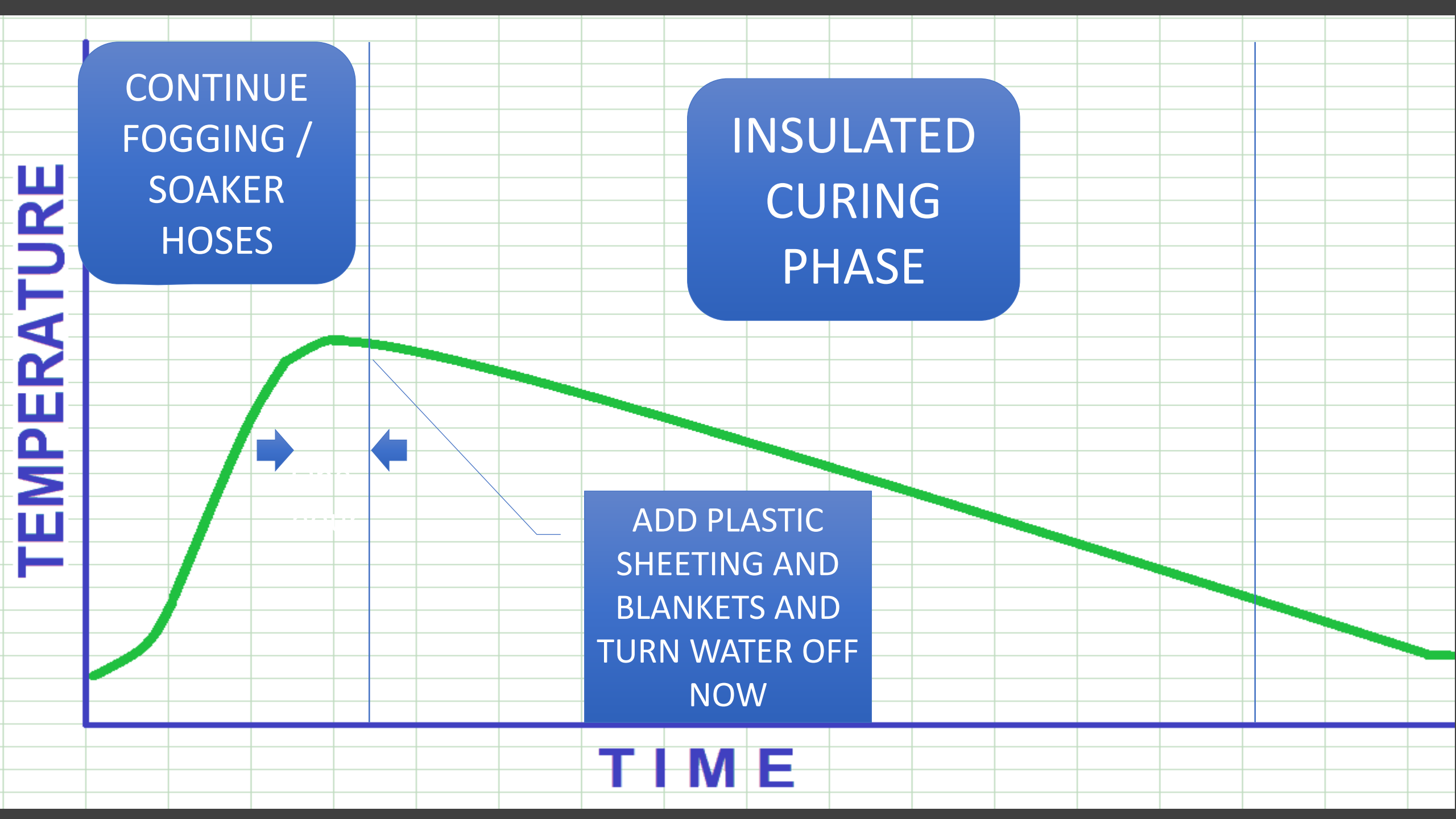
Monitoring Temperatures

- Outline
- Before Placement
- During Placement
- **Curing Sequence**

Continuous Moisture

- Outline
- Before Placement
- **During Placement**
- Curing Sequence

- Fog immediately after completion of finishing.
- Burlap (pre-soaked 24 hours)
- Fogging the burlap is continued to keep concrete cool.
- Soaker hoses placed when possible.
- One hour after concrete temps peak, plastic sheeting and concrete blankets are placed (silver side up) and water is turned off.


CONTINUE FOGGING / SOAKER HOSES
INSULATED CURING PHASE
TEMPERATURE
ADD PLASTIC SHEETING AND BLANKETS AND TURN WATER OFF NOW
TIME

Remove Curing Materials When:

- Outline
- Before Placement
- During Placement
- **Curing Sequence**

- Concrete is within 5 degrees of outside air temp, *and*
- Temperatures within the deck are uniform (within 10 degrees), *and*
- At least 96 hours cure time

Curing Comparison

Northbound Structure built 2016

Capitol Int.-
Cedar Int.
Project 2017

Southbound Structure built 2017

Curing Comparison

North Bound Structure 2019

Capital Int. –
Cedar Int.
Project 2019

South Bound Structure 2019

Questions?

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https://www.mdt.mt.gov/business/contracting/bridge/bridge_specials.shtml