

BRIDGE DECK CURING

NDDOT Construction Conference

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TOPICS

- CONCRETE BASICS
- WHAT CONCRETE PROPERTIES DO WE WANT FOR BRIDGE DECKS
- NDDOT BRIDGE DECK SPECIFICATIONS
- OBSERVATIONS ON PAST BRIDGE PROJECTS

CONCRETE BASICS

- Basic Ingredients
- Aggregate: Sand and Gravel
- Cement
- Water
- Mixed all together = Concrete

HYDRATION

- Hydration is the chemical reaction that we get when we mix water with cement.
- The cement water reaction is called exothermic which means that it generates heat.
- This reaction takes place over a long period of time sometimes even years.

HEAT OF HYDRATION

- Initial mixing generates a lot of heat for about the first 15 minutes.
- The concrete then goes into a dormant state for about 2 – 4 hours when there is little heat generated.
- This dormant period ends with initial set.

HEAT OF HYDRATION

- Then there is a period of 2-4 hours where the hydration accelerates and the amount of heat increases. This is the period where the concrete gains most of the required strength.
- Next there is a period of Hydration deceleration. This can go on for years.

IMPORTANCE OF HYDRATION

- Without this chemical reaction the concrete mixture would not harden. We would just have a mess of sand, gravel, water, and cement.
- It is thus very important to anyone wanting good concrete properties to insure that this chemical reaction called HYDRATION occurs in a manner that we get the kind of concrete that we want.

Concrete Properties We Want

- GOOD STRENGTH
- HIGH DURABILITY
- LOW PERMEABILITY
- NO CRACKS

THINGS WE DO TO GET IMPROVED PROPERTIES

- Add Air-Entrainment
- Add Fly Ash
- Water Reducing Admixture
- Shrinkage Reduction Admixture
- Various other Additives

The Most Important Thing to Do

- Insure proper Hydration
- What we need to do to have proper Hydration is called CURING

NDDOT Spec 602.03F Curing Concrete

- 1. General. All concrete surfaces not covered by forms shall be protected against evaporation of moisture for at least seven days.

NDDOT Spec 602.03F Curing Concrete

- 1. The curing periods shall be ten days when pozzolans in excess of 10 percent, by weight, of the Portland cement are used in the mix.

NDDOT Spec 602.03F Curing Concrete

- Why are we concerned about evaporation of moisture?

NDDOT Spec 602.03F Curing Concrete

- 1. General. If the concrete is exposed to air temperatures as low as 35°F or mean temperature is lower than 40°F on any day, the curing periods shall be extended the number of days the concrete is exposed to these low temperatures.

NDDOT Spec 602.03F Curing Concrete

- Why do we care about the temperature?

NDDOT Spec 602.03F.2. Methods

- a. Formwork
- b. Liquid Membrane Curing Compounds.
- c. Wet Cure

NDDOT Spec 602.03F. 2. c. Wet Cure

- The concrete shall be covered with a geotextile fabric or double thickness of burlap if forms are removed before the end of the seven-day curing period, ten days when pozzolans in excess of 10% are used.

NDDOT Spec 602.03F. 2. c. Wet Cure

- The geotextile fabric or burlap shall be kept continuously moist for seven days or covered with a waterproof material such as polyethylene until the end of the seven-day curing period, ten days when pozzolans in excess of 10% are used.

NDDOT Spec 602.03F. 2. c. Wet Cure

- Surface moisture shall be maintained between the final finish and placement of the covering by periodic applications of light fog spray.

NDDOT Spec 602.03F. 3. Deck Slab Concrete

- The deck concrete shall be cured according to Section 602.03 F.2.c, except:
- This means we can't count on Formwork or Liquid membrane Curing Compounds.

NDDOT Spec 602.03F. 3. Deck Slab Concrete exceptions

- That waterproof material shall not be used to cover the fabric or burlap.
- If the concrete surface begins to dry between the final finish and the beginning of the wet cure, it shall be kept moist by means of a light fog spray applied so as not to damage the surface of the concrete.

NDDOT Spec 602.03F. 3. Deck Slab Concrete exceptions

- The wet cure material shall be placed and the wet cure started no later than 30 minutes after the finish of the completed area.



NDDOT Spec 602.03F. 3. Deck Slab Concrete exceptions

- The burlap or fabric shall be moistened at a minimum of every four hours.



NDDOT Spec 602.03F. 3. Deck Slab Concrete exceptions

- If conditions exist such as strong winds or high temperatures, causing the burlap or fabric to become dry, the watering rate shall be increased.

NDDOT Spec 602.03F. 3. Deck Slab Concrete exceptions

- The use of curing compounds on the deck will not be allowed.

NDDOT Spec 602.03F. 3. Deck Slab Concrete exceptions

- No work shall be done on the deck while the wet cure is in progress.

NDDOT Spec 602.03F. 3. Deck Slab Concrete exceptions

- No vehicles or equipment not required in the curing process shall be on the deck.

Observations in Past Bridge Projects

- Exceeding the 30 minute placement of wet cure.

Observations in Past Bridge Projects

- Low Temperature provisions not followed.

Observations in Past Bridge Projects

- Materials, equipment, and work on deck during wet cure.

Observations in Past Bridge Projects

- Burlap is not being kept wet for the full 7 or 10 days.

Poker Tour 2011-2050

