DESLAURIERS

Concrete Forming and Testing Accessories

Subject: Re: Climate Control Box

The use of "climate control" for field storage of concrete test cylinders.

ASTM C31 (Making and Curing Concrete Test Specimens in the Field) Section 10.1.2 *Initial Curing* states "specimens shall be stored for a period up to 48 hours in a temperature range from 60 and 80 degrees F and in an environment preventing moisture loss from the specimens."

Note 5 elaborates as follows: "A satisfactory temperature environment can be controlled during the initial curing of the specimens by one or more of the following procedures: (1) use of ventilation, (2) use of ice, (3) use of thermostatically controlled heating or cooling devices, or (4) use of heating methods such as stoves or light bulbs. Other suitable methods may be used provided the requirements limiting specimen storage temperature and moisture loss are met."

Meeting this requirement tends be be more of a challenge in the summer than in the winter.

As the test cylinders hydrate (harden), the chemical reaction between the cement and the water generates heat. This is often referred to as "heat of hydration". This self generated heat can be captured by use of relatively close fitting boxes (such as our CURE or CURE-C) and generally will not require any external heat source unless it is extremely cold outside. A low wattage light bulb in the box during very cold nights will usually suffice. There are other requirements for field curing of the concrete in the forms, and it may be possible to place the field curing box or carton inside the thermal protection being used for the in-place concrete, thus providing added protection for the concrete specimens.

Summertime curing is a bigger problem, because the test specimens, by their nature, are generating heat in an already warm environment. Cooling units are available, but they are very expensive and require access to power, which is often a problem on projects (especially a DOT highway job out in the boonies). With no power, a generator would be required in addition to the cooling unit. At last check, these cooling units run in the $3,000 to $4,000 range (see www.spasteel.com), and no lab is going to spend this kind of money unless someone (like a Bechtel or other big outfit) buys it for them. On a sensitive project (like a nuclear power plant) this might happen. On a highway job, no way.

Experience has taught us that the best approach in summer is to use a combination of water and ice. The greatest heat of hydration occurs in the first 1 to 3 hours as the concrete hardens (initial set takes about an hour). If they use mostly ice with some water initially, the ice will be melting as the heat of hydration begins to diminish. Eventually they get down to just water, but the specimens are not generating as much heat. If they add a little ice to the water before they leave for the day they should be good, especially since night time temperatures should be more moderate.

The biggest key (and the most ignored) is to keep the specimens (and the field curing unit they are in) out of direct sunlight. If it is 95 degrees in the sun, it will be 85 in the shade and a lot less problem. When people express concern about our black molds absorbing heat in the sun, I point out that, per ASTM C31, they should not be in the sun to begin with.

Lastly, a very common mistake occurs when inspectors place a contact thermometer directly on a concrete test beam or cylinder and expect the temperature of the specimen to be controlled between 60 and 80 degrees. This is not possible, as the concrete is generating heat. The specification has been rewritten to help clarify that the 60 to 80 degree temperature requirement applies to the "curing environment", not the specimens themselves.

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