**Page 601-27 should include Subsection 601.16, Paragraph e). . . as shown**

1. When the ambient temperature is expected to fall below 40 °F during the curing period, the Contractor shall maintain the internal concrete temperature above 50 °F during the curing period and until the concrete has developed a compressive strength of 0.80f’c. The Contractor shall provide suitable measures such as straw, additional burlap, ground heaters, or other suitable blanketing materials, and/or housing and artificial heat to maintain the internal concrete temperature above 50 ºF.

Concrete shall not be placed on forms, girders, or deck panels that have a surface temperature less than 35 °F. Forms, girders, or deck panels where concrete is to be placed shall be free of snow, ice, and frost. Salt shall not be used to thaw ice, snow, or frost. Heating forms, girders, or deck panels prior to concrete placement may be required.

When the Contractor chooses to use an enclosure, the Contractor shall enclose the area underneath the deck and heat it so that the temperature of the enclosed air is as close as possible to the temperature of the enclosed air above the concrete. When artificial heating is used to maintain the concrete temperature, adequate ventilation shall be provided to limit exposure to carbon dioxide, and the enclosed air temperature shall not exceed 90 ºF. During the curing period, the Contractor shall monitor the air temperature within the enclosure at intervals acceptable to the Engineer. The Contractor shall monitor and maintain the structural integrity of the enclosure. Heating of the enclosure may be stopped after 72 hours if the air achieved 0.80f’c. For every day that the internal temperature of the concrete is below 50 ºF during the curing period, an additional day of curing with a minimum internal concrete temperature of 50 ºF will be required unless the concrete has achieved 0.80f’c. After completion of the required curing period, the Contractor shall remove the enclosure in such a manner that the temperature of the concrete during the following 24 hours does not fall by more than 25 °F.

When the Contractor chooses not to use an enclosure, after the curing period and after the concrete has achieved 0.80f’c, the Contractor shall remove the protection in such a manner that the temperature of the concrete during the following 24 hours does not fall by more than 25 °F. For every day that the internal temperature of the concrete is below 50 ºF during the curing period, an additional day of curing with a minimum internal concrete temperature of 50 ºF will be required unless the concrete has achieved 0.80f’c.

Internal concrete temperature shall be determined by using thermocouples. Thermocouple wire, connectors, and handheld thermometer shall be supplied by the Contractor. The Contractor shall install the thermocouples at locations designated by the Engineer.

Concrete compressive strength shall be determined by maturity meters. The Contractor shall develop maturity relationships for each mix placed during the cold weather conditions in accordance with CP 69. The maturity relationship shall be submitted to the Engineer prior to cold weather concrete placement. The Contractor shall provide the maturity meters and all necessary wires and connectors. The Contractor shall be responsible for the placement, protection, and maintenance of the maturity meters and wires. Locations where the maturity meters are placed shall be protected in the same manner as the rest of the concrete.

Heat sources shall not be placed in such a manner as to endanger formwork or expose any area of concrete to drying due to excessive temperatures.

If the internal concrete temperature at any location in the bridge deck concrete falls below 32 °F during the first 24 hours of the curing period, the Engineer may direct the Contractor to core the areas in question at the locations indicated by the Engineer. The Engineer will take immediate possession of the cores. The Engineer will submit the cores to a petrographer for examination in accordance with ASTM C856. Concrete damaged by frost, as determined by the petrographer, shall be removed and replaced at the Contractor's expense. All costs associated with coring, transmittal of cores, a petrographic examination shall be borne by the Contractor regardless of the outcome of the petrographic examination.