

EXPECTED IMPLEMENTATION JULY 2020

346 STRUCTURAL PORTLAND CEMENT CONCRETE (REV 1-21-20) (FA 1-23-20) (7-20)

SUBARTICLE 346-3.3 is deleted and the following substituted:

346-3.3 Mass Concrete: When the Contract Documents designate any structure as mass concrete, use a Specialty Engineer to develop and administer a Mass Concrete Control Plan (MCCP). Develop the MCCP in accordance with ACI Publications 207.1R Guide to Mass Concrete, 207.2R Report on Thermal and Volume Change Effects on Cracking of Mass Concrete, and 224R Control of Cracking in Concrete Structures Ensure that the concrete core temperatures for any mass concrete element do not exceed the maximum allowable temperature of 180°F and that the differential temperatures between the element core and surface do not exceed the maximum allowable temperature differential of 35°F. Submit the MCCP to the Engineer for approval at least 14 calendar days prior to the first anticipated mass concrete placement. Ensure the MCCP includes and fully describes the following:

1. The Financial Project Identification Number (FPID).
2. Contact names and numbers.
3. Names and qualifications of all designees who will inspect the installation of and record the output of temperature measuring devices, and who will implement temperature control measures.
4. The number, type, and dimensions of each mass concrete element to be constructed.
5. A sequential ID number assigned to each element indicating bridge number, element type, element size, and element location.
6. The mix design number of the concrete used to construct each element.
7. Indicate which mass concrete elements will be monitored.
8. Casting procedures,
9. Insulating systems,
10. Type and placement of temperature measuring and recording devices, as well as any remote monitoring devices and software.
11. For each concrete mix design and concrete element, include a table formatted as shown below, listing the maximum allowable concrete placement temperature for each ambient temperature range at time of placement, in 10°F increments from 40°F and 99°F.

Mix Design No.	Maximum Allowable Concrete Placement Temperature (°F)	
Ambient Temperature at Time of Placement	Footer W by L by H (ft)	Column D by H (ft)
40° - 49°F		
50° - 59°F		
Mix Design No.	Maximum Allowable Concrete	

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Ambient Temperature at Time of Placement	Placement Temperature (°F)	
	Footer W by L by H (ft)	Column D by H (ft)
60° - 69°F		
70° - 79°F		
80° - 89°F		
90° - 99°F		

12. Measures to prevent thermal shock.

13. Active cooling measures, if used.

Do not place concrete until the MCCP has received written approval, and fully comply with its requirements. Any modifications must be submitted as addenda to the original MCCP and must be approved in writing by the Engineer. Ensure that, prior to the first concrete placement of each concrete element the Specialty Engineer or approved designee personally inspects the installation of the temperature measuring devices and verifies that the temperature data acquisition equipment is functioning properly. The temperature data acquisition equipment must record temperature readings at least once per hour, beginning at the completion of concrete placement and continuing until the core temperature is within 50°F of the ambient temperature. The Specialty Engineer shall be available for immediate consultation during the monitoring period of any mass concrete element. Monitor temperature readings at least once every six hours. Within three working days of the completion of temperature recording for each concrete element, submit an electronic spreadsheet file, editable report to the Engineer that includes the element identification, date and time of any changes to the temperature control measures, all original temperature readings and curing notes. Also submit data logger summaries and graphs, and results of the visual inspection of each element.

If the first element of a group of elements with the same dimensions is placed in accordance with the approved MCCP, without exceeding either the maximum temperature or maximum temperature differential of the concrete, reduced monitoring of the remaining elements may be allowed with written approval from the Engineer. Request approval from the Engineer at least 14 calendar days prior to the anticipated date of reduced monitoring. If approved, temperature monitoring is required only for the initial element of a group of concrete elements meeting all of the following requirements:

1. All elements have the same dimensions.
2. All elements have the same concrete mix design.
3. All elements have the same insulation R value and active cooling measures (if used).
4. Ambient temperatures during concrete placement for all elements are within minus 10°F of the ambient temperature during placement of the initial element.
5. Use the same temperature control measures used for the initial monitored element and keep in place for at least the same length of time as for the initial element. The Contractor and Engineer each have the option to have the temperature monitored to ensure the core temperature is within 50°F of ambient prior to termination of temperature control measures.

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Install temperature measuring and recording devices for all mass concrete elements. Position the temperature sensors 2.00 ± 0.25 inches inside the concrete surface for surface temperature measurements and at the expected location of the maximum temperature for core temperature measurements. Place the ambient temperature sensor in a location that protects it from direct exposure to rain, sun, or sources of radiated heat, such as concrete or asphalt pavement surfaces. Temperatures shall be continuously recorded starting at the end of concrete placement and continuing until the core has cooled to within 50°F of the ambient temperature. Resume monitoring of the temperatures for all elements if directed by the Engineer.

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Instrumentation and temperature monitoring are not required for drilled shafts supporting sign, signal, lighting or intelligent transportation (ITS) structures that meet all of the following requirements:

1. The diameter is six feet or less.
2. The total cementitious materials content of the concrete mix design is less than or equal to 750 pounds per cubic yard.

Temperature monitoring may be omitted at the Contractor's option, for any mass concrete substructure element meeting all of the following requirements:

1. The minimum cross-sectional dimension of the element is six feet or less.
2. Insulation with an R-value of at least 2.5 must be provided for at least 72 hours following the completion of concrete placement.
3. The environmental classification of the concrete element is slightly aggressive or moderately aggressive.
4. The concrete mix design meets the mass concrete proportioning requirements of 346-2.3.
5. The total cementitious material content of the concrete mix design is less than or equal to 750 pounds per cubic yard.
6. Temperature of the concrete is 95°F or less at placement.

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Implement immediate corrective action as directed by the Specialty Engineer when either the core temperature or the temperature differential of any mass concrete element exceeds its maximum allowable value. The approval of the MCCP shall be revoked. Do not place any mass concrete elements until a revised MCCP has been approved in writing by the Engineer. Submit an Engineering Analysis Scope in accordance with 6-4 for approval, which addresses the structural integrity and durability of any mass concrete element that is not cast in compliance with the approved MCCP or which exceeds the allowable core temperature or temperature differential. Submit all analyses and test results requested by the Engineer for any noncompliant mass concrete element to the satisfaction of the Engineer. The Department will make no compensation for additional costs or loss of time due to additional analyses, tests, or other impacts on production caused by the use of reduced monitoring or the Contractor's option.

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