

January 1, 2022

General

By: _____
FEDERAL HIGHWAY ADMINISTRATION

Delete Subsection 702.4.2.5 of the Standard Specifications in its entirety and replace it with the following:

702.4.2.5 Mass Concrete Placement

Requirements for the use of mass concrete procedures are a function of equivalent cement content (ECC) of the concrete mix and the dimensions of the pour. ECC shall be determined on a per cubic yard basis with the following formula:

$$\text{ECC} = 1.0(\text{PC}) + 0.5(\text{FAF}) + 0.8(\text{FAC}) + 1.2(\text{SF}) + 1.0(\text{SC})$$

Where:

PC = portland cement, FAF = Class F fly ash, FAC = Class C fly ash, SF = silica fume, and SC = slag cement. All units are in pounds per cubic yard.

SCDOT requires the use of mass concrete procedures as outlined below:

- For concrete mixes with an ECC < 650 pounds per cubic yard, use procedures for mass concrete placement for a pour that has dimensions of 5 feet or greater in 3 different directions. In the case of a circular cross-section, a mass concrete placement is defined as a pour that has a diameter of 6 feet or greater and a length of 5 feet or greater.
- For concrete mixes with an ECC ≥ 650 pounds per cubic yard, use procedures for mass concrete placement for a pour that has dimensions of 4 feet or greater in 3 different directions. In the case of a circular cross-section, a mass concrete placement is defined as a pour that has a diameter of 5 feet or greater and a length of 4 feet or greater.
- Mass concrete requirements do not apply to Foundation Seals (Class 4000S).

For all mass concrete pours, do not allow the maximum temperature during curing to exceed the temperatures listed below:

- For concrete mixes where the total cementitious materials consist of at least 25% Class F fly ash, 35% Class C fly ash, or 35% water granulated blast furnace slag by weight, the maximum temperature during curing shall not exceed 180°F.
- For all other concrete mixes, the maximum temperature during curing shall not exceed 160°F.

For all mass concrete pours, do not allow the mix temperature to exceed 80°F measured at discharge into the forms or shaft. With the exception of permanently cased drilled shafts, maintain a temperature differential of 35°F or less between the interior and exterior of all mass pour elements during curing. Temperature differential management is not required for drilled shafts that utilize construction casing in accordance with **Subsection 712.4.8.3.**

No later than 30 days before placing mass concrete, submit to the BCE for review and acceptance a *Mass Concrete Placement Plan* containing, but not limited to, the following:

- Concrete mix design to be used for the mass concrete pour,
- Analysis of the anticipated thermal developments within mass pour placements using the proposed materials and casting methods,

SUPPLEMENTAL SPECIFICATION

- *Temperature Control Plan* outlining specific measures to control the maximum temperature and differential within the limits noted above, and

- Details of the proposed monitoring system.

Submit for review by the OMR all special concrete mix designs, which are part of the *Temperature Control Plan*. Do not use High-early-strength (AASHTO M 85 Type III) cement or accelerating admixtures in mass concrete. As an additional measure to aid in temperature control of mass concrete elements, up to 35% of the minimum cement content may be replaced with fly ash.

Provide temperature monitoring devices to ensure the requirements of this specification are met. Temperature monitoring devices shall collect and record a minimum of one data point per hour. Redundancy shall be provided such that loss of a single monitoring device does not result in the inability to verify the requirements of this specification. Provide the RCE with a copy of each set of readings and a temperature chart for each mass pour element showing temperature readings vs. time. Temperature data shall be provided to the RCE on a daily basis through the conclusion of monitoring. The RCE, at their discretion, may suspend subsequent mass concrete placements for failure to comply with the reporting requirements herein.

An exclusion to the temperature monitoring requirements will be permitted for drilled shafts meeting all of the following conditions:

1. Shaft diameter less than 10 feet (thickness of casing, if present, may be excluded from measurement),
2. Total cementitious materials within concrete mix consists of at least 25% Class F fly ash by weight,
3. ECC of concrete mix is less than or equal to 575 pounds per cubic yard, and
4. Placement temperature of 80 °F or less.
5. Use of construction casing in accordance with **Subsection 712.4.8.3**.

For drilled shafts not meeting all of the conditions outlined above, place temperature monitoring devices on 10-foot maximum intervals from the mid-depth to the top of the shaft. Monitors should not be placed within one shaft diameter from the top of the shaft. For shafts less than 40 feet in length, a minimum of 2 elevations shall be monitored. For uncooled shafts, monitoring locations should be centrally located. Minor offsets may be permitted to allow for tremie access if permitted by the BCE. Where cooling tubes are utilized, monitoring locations shall be laterally placed at the estimated center of heat generation. Coordinate the placement of temperature monitoring devices with shaft reinforcing and CSL access tubes provided in accordance with Section 727 of the Standard Specifications. Do not provide additional access tubes around the perimeter of the reinforcing cage that will reduce reinforcing clearances. Do not use monitoring equipment cast into shafts that will interfere with CSL testing. Continue monitoring temperatures in drilled shafts for a minimum of 36 hours after the maximum temperature is measured.

For all other mass concrete placements, record temperature development between the location of maximum heat and exterior of the element at points accepted by the BCE and closely monitor the mass pour maximum temperature and temperature differential. Generally, use one monitoring point in the center of the largest mass of concrete and a second point approximately 2 inches inside the face nearest to the first monitoring point. Continue monitoring temperature until the interior temperature is within 35°F of the lowest ambient temperature or a maximum of two weeks.

If the monitoring indicates that the proposed measures are not controlling the concrete temperatures as specified herein, provide to the BCE an engineering assessment of the short and long-term impacts associated with the non-conformance. All costs associated with inspection, testing, and evaluation of the non-conformance are the sole responsibility of the Contractor. Additionally, make the necessary revisions to the *Temperature Control Plan* and submit the revised plan for review. No additional mass concrete placements will be allowed until the required items have been provided and accepted by the BCE.

SUPPLEMENTAL SPECIFICATION

The Contractor assumes all risks connected with placing a mass pour of concrete. BCE review of the Contractor's *Mass Concrete Placement Plan* will in no way relieve the Contractor of the responsibility for obtaining satisfactory results. Should any mass concrete placed under this specification prove unsatisfactory in the judgement of the Department, make the necessary repairs or remove and replace the material at no expense to the Department.

Provide the control of temperatures in mass concrete pours in addition to any other requirements found on the Plans and/or in the Special Provisions that apply to the work in question. Include all costs associated with temperature controls for mass concrete placement in the unit cost of the concrete.