

**SECTION 02001 - CONCRETE**

*(Follow all instructions and make all edits with "Track Changes" turned on. If there are no instructions [purple text] above a subsection, paragraph, sentence, or bullet, then include it in the Project. Delete all purple text before preparing the final document. All other modifications to this Section will require ODOT Technical Resource and State Specifications Engineer approval.)*

Comply with Section 02001 of the Standard Specifications modified as follows:

**02001.15 Concrete Mix Design** - Replace the paragraph that begins "Submit current or new mix ..." with the following paragraph:

Submit current or new mix designs, prepared by a CCT, with the information listed in 02001.15(c), for each required class of concrete to the Engineer for review. Allow 21 Calendar Days for the review. Design mixes by the volumetric method in ACI 211.1 to achieve the properties of 02001.20 and 02001.30 when tested according to 02001.15(b). Provide a design that is workable, placeable and finishable given the specific conditions for the Project and Structure. Do not proceed with concrete placement until the Engineer has determined that the mix design complies with the Specifications. Review of concrete mix designs does not relieve the Contractor of the responsibility to provide concrete meeting the Specification and Project Site requirements.

**02001.15(a) Current Mix Design** - Replace this subsection, except for the subsection number and title, with the following:

Mix designs that meet the requirements for the specified class of concrete and are currently being used or have been used within the past 24 months on any project, public or private may be submitted for review. Provide individual tests results that comprise the average if more than one data point exists. Provide flexural strength testing for paving designs from within the last two years. Provide length change and permeability tests for HPC designs from within the last two years.

**02001.15(b) New Mix Designs** - Replace this subsection, except for the subsection number and title, with the following:

Make at least one trial batch for each concrete mix design. Notify the Engineer at least 48 hours before making each trial batch. The Engineer may witness preparation and testing. Prepare and test trial batches using the same Materials, at the same proportions, and having the same plastic properties of concrete that are used in the Project. Simulate haul time, batching sequence and mixing conditions to ensure the trial batch is representative of the mixture that is delivered to the Project. Furnish all Materials, Equipment, testing and Work required for designing the mixes at no additional cost to the Agency.

**02001.15(b)(1) Trial Batch Plastic Properties** - Replace the test method that begins "AASHTO T 23..." with the following test method:

AASHTO R 100 or R 39 <sup>3</sup>

**02001.15(b)(2)(a) Compressive Strength Tests** - Replace this subsection, except for the subsection number and title, with the following:

For each trial batch, cast and cure at least three test cylinders according to AASHTO R 100 or AASHTO R 39, in 6-inch by 12-inch or 4-inch by 8-inch single use plastic molds. The use of unbonded caps according to ASTM C1231 is permitted. Test at 28 Days according to AASHTO T 22.

**02001.15(b)(2)(b) Flexural Strength Tests** - Replace this subsection, except for the subsection number and title, with the following:

For each paving concrete trial batch, cast and cure at least three flexural beams according to AASHTO R 100 or AASHTO R 39. Test flexural beams at 28 Days according to AASHTO T 97.

**02001.15(b)(2)(c) Length Change Tests** - Replace this subsection, except for the subsection number and title, with the following:

For all HPC mix designs, except for precast or prestressed elements, make at least three specimens from the trial batch for length change testing. Provide sample prisms ~~that~~ have a square, 4-inch by 4-inch Cross Section. Wet cure the samples until they have reached an age of 28 Days, including the period in the molds. Following the wet cure, air store and measure samples according to AASHTO T 160, Section 11.1.2 for 28 Days. Report length change results at total specimen age of 56 Days.

**02001.15(b)(2)(d) Permeability Tests** - Replace this subsection, except for the subsection number and title, with the following:

For alternate HPC mix designs, select from the following options:

- Make at least three specimens from the trial batch for permeability testing. Prepare, cure, dry and test according to AASHTO T 277. Report permeability in coulombs at 90 Days.
- Make at least two specimens from the trial batch for resistivity testing. Prepare, cure and test according to AASHTO T358 using the sealed conditioning method. Report resistivity in kΩ·cm at 56 Days.

**02001.15(c) Required Submittals for Mix Designs** - Replace the title of this subsection with "Submittals for Mix Designs"

**02001.20 Concrete properties, Tolerances, and Limits** - Replace the paragraph that begins "Provide concrete that is..." with the following paragraph:

Furnish concrete that is workable, placeable, uniform in composition and consistency, and having the following properties:

**02001.20(a) Strength** - Replace the paragraph that begins "Provide concrete meeting ..." with the following paragraph:

Furnish concrete meeting the required classes shown in the Contract Documents. The class of concrete designates the minimum required compressive strength,  $f'_c$  at 28 Days.

**02001.20(b) Air Entrainment** - Replace the paragraph that begins "Provide all concrete..." with the following paragraph:

Furnish all concrete, except PPCM with cast-in-place decks, seal concrete, and drilled shaft concrete with entrained air in the amounts shown in Table 02001-2. Provide field measured entrained air content within  $\pm 1.5$  percent of target air entrainment values.

**02001.20(c) Slump** - Replace the paragraph that begins "Provide concrete..." with the following paragraph:

Furnish concrete at the appropriate slump shown in Table 02001-3. Take corrective action to maintain a consistent slump at the point of discharge from the delivery vehicle.

**02001.20(d) Temperature** - Replace the paragraph that begins "Provide concrete..." with the following paragraph:

Provide concrete, at time of placement, at a temperature between a minimum of 50 °F and a maximum of 90 °F, except the maximum bridge deck concrete temperature is 80 °F.

**02001.20(e) Durability** - Replace this subsection, except for the subsection number and title, with the following:

For HPC designs the following additional requirements apply:

Test	Test Method	Acceptance Value
Length Change	AASHTO T 160	-0.045% <sup>1</sup>
Permeability	AASHTO T 277	1,000 Coulombs (max.) at 90 Days <sup>2</sup>

<sup>1</sup> Not required for precast or prestressed elements.

<sup>2</sup> Only required for alternate HPC designs. See 02001.30(b)(2). A minimum resistivity of 37.0 k $\Omega$ ·cm at 56 Days for 4x8 inch cylinders and 29 k $\Omega$ ·cm at 56 Days for 6x12 inch cylinders are accepted as equal when tested according to AASHTO T 358 using the sealed conditioning method.

*(Use the following lead-in paragraph and subsection .20(f) when IC is specified.)*

Add the following subsection:

**02001.20(f) Internal Curing** - For HPC(IC) concrete, internally cure the mixture according to the following:

- Substitute 350 lbs (SSD) LWFA for standard Fine Aggregate.

*(Use the following lead-in paragraph and subsection .20(g) when lightweight concrete is required. Contact the Statewide Structural Materials Engineer who will provide densities to be used to fill in the blanks.)*

Add the following subsection:

**02001.20(g) Unit Weight** - Furnish high performance lightweight concrete with a maximum plastic density of \_\_\_\_\_ pounds per cubic foot at time of placement and a maximum calculated approximate equilibrium density of \_\_\_\_\_ pounds per cubic foot.

**02001.30(a) Portland Cement** - Replace this subsection, except for the subsection number and title, with the following:

For structural or paving concrete applications use cement according to 02010.10 or 02010.20, excluding Type III. Use Type III cement for precast prestressed concrete.

**02001.30(b)(1) General Limits** - Replace the paragraph that begins "\*Fly ash + other..." with the following paragraph:

\*Furnish fly ash + other Pozzolans at a rate no more than 25% and silica fume at a rate no more than 5% of the total weight of Cementitious Materials.

**02001.30(b)(2) HPC Cementitious Composition** - Replace this subsection, except for the subsection number and title, with the following:

Cement with SCM proportioned according to 02001.30(b)(1) and with trial batches performed to demonstrate that the proposed alternate mix design provides a maximum of 1,000 coulombs at 90 Days when tested according to AASHTO T 277 or a minimum resistivity of 37.0 kΩ·cm at 56 Days for 4x8 inch cylinders and 29 kΩ·cm at 56 Days for 6x12 inch cylinders are accepted as equal when tested according to AASHTO T358 using the sealed conditioning method.

**02001.30(f) Synthetic Fiber Reinforcing for Concrete** - Replace this subsection, except for the subsection number and title, with the following:

Except for precast or prestressed elements, use synthetic fiber reinforcing from the QPL and according to Section 02045 in all HPC. Use synthetic fiber reinforcing according to the manufacturer's recommendations at the rate designated on the QPL. Fiber packaging is not allowed in the mixed concrete.

**02001.40 Concrete Production** - Replace the paragraph that begins "<sup>1</sup> When haul time or ..." with the following paragraph:

<sup>1</sup> When haul time or placement conditions warrant exceeding the time of discharge, submit a detailed breakdown of the estimated time needed from batching to discharge of a load along with the measures that are taken to ensure slump, temperature and uniformity is maintained. Submit this request in advance and may establish a new time limit at the Engineer's discretion.

**02001.40(a) Delivery Tickets** - Replace the paragraph that begins "Send a concrete delivery ..." with the following paragraph:

Send a concrete delivery ticket with each load of concrete supplied to the Project. Include the following information on each delivery ticket:

**02001.40(b) Adjusting Concrete Proportions** - Replace the bullet that begins "Large admixture dosage changes..." with the following bullet:

- Large admixture dosage changes, excluding adjustments for air entraining agents and Type A or D water reducers ( $\pm 25$  oz/cubic yard).

**02001.50 Quality Control** - Replace the bullet that begins "The Contractor shall..." with the following bullet:

- Designate a person responsible for accepting and rejecting concrete on-site.

**02001.50(c) Concrete Control Technician (CCT)** - Replace the bullet that begins "Make adjustments to loads ..." with the following bullet:

- Make adjustments to loads that fail to meet the air content or slump criteria of the Specifications prior to the 90-minute time limit. Make adjustments complying with the provisions of ASTM C94.

**02001.60 Acceptance of Concrete** - Replace this subsection, except for the subsection number and title, with the following:

Acceptance of concrete is according to Section 00165 and the following:

**(a) Aggregate** - Acceptance of Aggregate is according to 02690.12.

**(b) Plastic Concrete** - Acceptance of plastic concrete is based on tests performed by the Contractor's QCT, according to the tolerances and limits of 02001.20, when discharged within the time allotted in 02001.40.

**(c) Hardened Concrete** - ~~02001.60(c) Hardened Concrete~~ - Replace the paragraph that begins "Cast and cure test specimens..." with the following paragraph:

Cast and cure test specimens according to AASHTO R 100 in 6-inch x 12-inch or 4-inch x 8-inch, single-use plastic molds and test at 28 Days according to AASHTO T 22.

**(1) General** - For all classes of concrete, acceptance of hardened concrete is based on an analysis of compressive strength tests of cylinders cast by the QCT. Test cylinders at an Agency certified laboratory.

**(2) Acceptance** - Hardened concrete with an ASTV meeting or exceeding the specified design strength,  $f'_c$  is accepted for strength. If the ASTV is less than  $f'_c$  but at least 85 percent of  $f'_c$ , the Engineer may review the results to determine if the concrete represented by the cylinders is suitable for the intended purpose. Remove concrete that has an ASTV less than 85 percent of  $f'_c$  unless otherwise authorized, in writing, by the Engineer. If the concrete is removed, the cost of removal, replacement and all related Work is the Contractor's responsibility. If the Engineer determines that the concrete is suitable for the intended purpose, the concrete may be allowed to remain

in place, subject to a price adjustment according to 00150.25. If an ASTV falls below  $f'_{cs}$ , the Contractor may submit a written plan outlining a proposed alternate method of evaluating compressive strength. Submit the plan for review by the Engineer within 3 Days of the test. Provide evidence that a reasonable  $f'_{cr}$  (over-design) was maintained and that there is credible evidence (besides low strength) that warrants consideration of this option. The Engineer may allow an alternate method of acceptance if the compressive strength test results are determined to be suspect from definable external factors.