October 1, 2023

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Revision of Section 601
Structural Concrete

Revise Section 601 of the Standard Specifications as follows:

Revise Section 601.02 by deleting all references to Concrete Class G, as shown:

601.01 This work consists of furnishing and placing hydraulic cement concrete in accordance with these specifications and in conformity with the lines, grades and dimensions as shown on the plans or established.

This work includes preparing concrete surfaces designated in the Contract and applying an approved colored Structural Concrete Coating to them.

601.02 Classification. The classes of concrete shown in Table 601-1 shall be used when specified in the Contract.

Table 601-1
CONCRETE FIELD REQUIREMENTS

Concrete Class	Required Field Compressive Strength (psi)	Air Content: % Range (Total)	Slump#	Maximum Water/Cementitious Material Ratio:
B	4500 at 28 days	5 - 8	+/- 2" of Form 1373 Slump	w/cm on Form 1373
BZ	4000 at 28 days	N/A*	6" – 9"	w/cm on Form 1373
D	4500 at 28 days	5 – 8	+/- 2" of Form 1373 Slump	w/cm on Form 1373
DT	4500 at 28 days	5 – 8	+/- 2" of Form 1373 Slump	w/cm on Form 1373
PS (Girders)	8500 at 28 days	N/A*	9" maximum	0.45
PS (Deck Panels)	6000 at 28 days	N/A*	9" maximum	0.45
P	4500 at 28 days	4 – 8	+/- 2" of Form 1373 Slump	w/cm on Form 1373
S35	5000 at 28 days	5 – 8	+/- 2" of Form 1373 Slump	w/cm on Form 1373
S40	5800 at 28 days	5 – 8	+/- 2" of Form 1373 Slump	w/cm on Form 1373
S50	7250 at 28 days	5 – 8	+/- 2" of Form 1373 Slump	w/cm on Form 1373
Shotcrete	4500 at 28 days	7-10 ◂	N/A	0.45

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Table 601-1 Notes:
* 5 - 8% when specified.
# Slump shall be a maximum of 9.0 inches for all classes of concrete. Concrete may have a slump above 9.0 inches when designed as Self Consolidating Concrete (SCC). The requirements for slump flow, blocking assessment, and segregation shall apply.
◂ Prior to pumping for wet process.

Class B concrete is an air entrained concrete for general use. Class D or P concrete may be substituted for Class B concrete. Additional requirements are:

(1) The coarse aggregate shall have a nominal maximum size of 1½ inches or smaller.

(2) Class B Concrete for Slope and Ditch Paving shall be macro-fiber reinforced.

Class BZ concrete is concrete for drilled shafts. Additional requirements are:

(1) Entrained air is not required unless specified in the Contract. When entrained air is specified in the Contract, the air content shall be 5 to 8 percent.

(2) Slump shall be a minimum of 6 inches and a maximum of 9 inches. A minimum slump of 6 inches shall be maintained during the anticipated pour period. The use of retarders and hydration stabilizers are allowed to extend the slump life of the concrete. When the Contractor elects to use SCC, the slump requirement for Class BZ Concrete does not apply.

(3) The coarse aggregate size shall be AASHTO M43 size #8 unless otherwise approved by the Engineer.

(4) The mix shall either have a permeability not exceeding 2,500 coulombs at an age of not more than 56 days when tested in accordance with ASTM C1202, or have a surface resistivity of at least 12 kΩ-cm at 28 days using AASHTO T358.

(5) The unrestrained shrinkage shall not exceed 0.050 percent at 28 days when tested by CP-L 4103.

Class D concrete is a denser general use concrete. Additional requirements are:

(1) The mix shall either have a permeability not exceeding 2,500 coulombs at an age of not more than 56 days when tested in accordance with ASTM C1202, or have a surface resistivity of at least 12 kΩ-cm at 28 days using AASHTO T358.

(2) The unrestrained shrinkage shall not exceed 0.050 percent at 28 days when tested by CP-L 4103.

(3) The mix may use an optimized gradation (OG) with a nominal maximum aggregate size of at least ¾ inch.

(4) The mix shall have a nominal maximum aggregate size of at least ¾ inch if an OG is not used.

(5) When used in slip forming, an edge slump less than 6 mm (0.25 in.) and less than 30 percent surface voids (ranking of 2 or less) is required. The box test is described in CP 63.

(6) Class D Concrete for sidewalks on bridge decks and bridge rail shall be macro-fiber reinforced.

Class DT concrete is used for bridge deck resurfacing. Additional requirements are:

(1) The concrete mix shall consist of a minimum 50 percent AASHTO M 43 size No. 7 or No. 8 coarse aggregate by weight of total aggregate.

(2) The mix shall either have a permeability not exceeding 2,500 coulombs at an age of not more than 56 days when tested in accordance with ASTM C1202 or have a surface resistivity of at least 12 kΩ-cm at 28 days using AASHTO T358.

(3) The unrestrained shrinkage shall not exceed 0.050 percent at 28 days when tested by CP-L 4103.

Class P concrete is used in pavements. Additional requirements are:

(1) The Required Field Flexural Strength shall be 650 psi.

(2) The concrete mix shall consist of a minimum 55 percent AASHTO M 43 sizes No. 57, No. 6, No. 67, No. 357, or No. 467 coarse aggregate by weight of total aggregate.

(3) The mix may use an OG with a nominal maximum aggregate size of at least ¾ inch.

(4) ASTM C150 Type III and ASTM C1157 Type HE cements may be used for early opening.

(5) The mix shall either have a permeability not exceeding 2,500 coulombs at an age of not more than 56 days when tested in accordance with ASTM C1202, or have a surface resistivity of at least 12 kΩ-cm at 28 days using AASHTO T358.

(6) The unrestrained shrinkage shall not exceed 0.050 percent at 28 days when tested by CP-L 4103.

(7) When concrete is to be placed using a paver, an edge slump less than 6 mm (0.25 in.) and less than 30 percent surface voids (ranking of 2 or less) is required. The box test is described in CP 63.

(8) A minimum of 20 percent Class F fly ash or 30 percent Slag cement by weight shall be used to replace any ASTM C150 cement, any ASTM C1157 cement, or ASTM C595 Type IL cement. ASTM C595 Type IT(MS), IT(HS), IP(MS) or IP(HS) cements may be used without cement substitutions. Class C fly ash may be used if the calcium oxychloride is determined to be less than 15 g CaOXY/100 g cementitious paste as determined in accordance with AASHTO T 365 for Class 0 Sulfate Exposure.

Class PS Class PS concrete is used for prestressed concrete members. Requirements for Class PS concrete are specified in subsection 618.11. ASTM C150 Type III and ASTM C1157 Type HE cements may be used.

Class S35, S40, and S50 concretes are dense high strength concretes. Additional requirements are:

(1) The concrete mix shall be made with AASHTO M 43 sizes No. 57, No. 6, No. 67, No. 7 or No. 8 course aggregate.

(2) When placed in a bridge deck, the mix shall have a nominal maximum aggregate size of at least 3/4 inch.

(3) The mixes may use an OG with a nominal maximum aggregate size of at least 3/4 inch.

(4) For S35 and S40 concretes, the unrestrained shrinkage shall not exceed 0.050 percent at 28 days when tested by CP-L 4103.

(5) For S50 concretes, the unrestrained shrinkage shall not exceed 0.040 percent at 28 days when tested by CP-L 4103.

(6) For S35 and S40 concretes, the mix shall either have a permeability not exceeding 2,000 coulombs at an age of not more than 56 days when tested in accordance with ASTM C1202, or have a surface resistivity of at least 14 kΩ-cm at 28 days using AASHTO T358.

(7) For S50 concrete, the mix shall either have a permeability not exceeding 1,500 coulombs at an age of not more than 56 days when tested in accordance with ASTM C1202, or have a surface resistivity of at least 18 kΩ-cm at 28 days using AASHTO T358.

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Class Shotcrete concrete is used for shotcrete applications. Additional requirements are:

(1) The required air content prior to the pump for wet process applications shall be 7–10 percent.

(2) Additional requirements are listed in subsection 641.02.

The Contractor may design Class B, Class BZ, Class D, Class PS, Class S35, Class S40, and Class S50 concrete to be Self Consolidating Concrete (SCC) with the following requirements:

(1) SCC shall have a slump flow of 20 to 26 inches when tested in accordance with ASTM C1611 using an inverted slump cone.

(2) SCC shall have a maximum blocking assessment of 2.0 inches when tested in accordance with ASTM C1621.

(3) SCC shall have a maximum static segregation of 10 percent when tested in accordance with ASTM C1610.