November 8, 2018

REVISION OF SECTIONS 601, 701 AND 711
STRUCTURAL CONCRETE

**NOTICE**

This is a standard special provision that revises or modifies CDOT’s *Standard Specifications for Road and Bridge Construction.* It has gone through a formal review and approval process and has been issued by CDOT’s Project Development Branch with formal instructions for its use on CDOT construction projects. It is to be used as written without change. Do not use modified versions of this special provision on CDOT construction projects, and do not use this special provision on CDOT projects in a manner other than that specified in the instructions unless such use is first approved by CDOT’s Standards and Specifications Unit. The instructions for use on CDOT construction projects appear below.

Other agencies which use the *Standard Specifications for Road and Bridge Construction* to administer construction projects may use this special provision as appropriate and at their own risk.

**Instructions for use on CDOT construction projects:**

Use on all projects with structural concrete.

Sections 601 and 701 of the Standard Specifications are hereby revised for this project as follows:

In subsection 601.02, after the thirteenth paragraph, delete item (2) and replace it with the following:

(2) The maximum amount of fly ash substituted for ASTM C150 cement or the maximum pozzolan content when ASTM C595 or C1157 cement is used may exceed the limits in subsection 601.05 if lab test results show that the permeability of the mix does not exceed 2,500 Coulombs at an age of not more than 56 days as determined by ASTM C1202.

Subsection 601.03 shall include the following:

Slag Cement 701.05

In subsection 601.04, under Class 1 requirements for sulfate resistance, delete items (5) and (6) and replace them with the following:

(5) ASTM C595 Type IL(MS), IL(HS), IT(MS) or (HS); Class C fly ash shall not be substituted for cement.

In subsection 601.04, under Class 2 requirements for sulfate resistance, delete items (1), (2), (5), (6), (7), (8) and (9) and replace them with the following:

(1) ASTM C150 Type V with a minimum of a 20 percent substitution of Class F fly ash or slag cement by weight

 (2) ASTM C150 Type II or III with a minimum of a 20 percent substitution of Class F fly ash or slag cement by weight. The Type II or III cement shall have no more than 0.040 percent expansion at 14 days when tested according ASTM C452

(5) ASTM C1157 Type MS plus Class F fly ash, slag cement, or High-Reactivity Pozzolan where the blend has less than 0.05 percent expansion at 6 months or 0.10 percent expansion at 12 months when tested according to ASTM C1012

(6) A blend of portland cement meeting ASTM C150 Type II or III with a minimum of 20 percent Class F fly ash or slag cement by weight, where the blend has less than 0.05 percent expansion at 6 months or 0.10 percent expansion at 12 months when tested according to ASTM C1012.

(7) ASTM C595 Type IP(HS), IL(HS) or IT(HS). Class F fly ash, slag cement, or High-Reactivity Pozzolan may be substituted for Type IL cement. Class C fly ash shall not be substituted for cement.

(8) ASTM C595 Type IL(MS) or IT(MS) plus Class F fly ash, slag cement, or High-Reactivity Pozzolan where the blend has less than 0.05 percent expansion at 6 months or 0.10 percent expansion at 12 months when tested according to ASTM C1012

In subsection 601.04, under Class 3 requirements for sulfate resistance, delete items (1), (2), (3), (5), (6) and (7) and replace them with the following:

(1) A blend of portland cement meeting ASTM C150 Type II, III, or V with a minimum of a 20 percent substitution of Class F fly ash or slag cement by weight, where the blend has less than 0.10 percent expansion at 18 months when tested according to ASTM C1012.

(2) ASTM C 1157 Type HS having less than 0.10 percent expansion at 18 months when tested according to ASTM C1012. Class F fly ash, slag cement, or High-Reactivity Pozzolan may be substituted for cement. Class C fly ash shall not be substituted for cement.

(3) ASTM C1157 Type MS or HS plus Class F fly ash, slag cement, or High-Reactivity Pozzolan where the blend has less than 0.10 percent expansion at 18 months when tested according to ASTM C1012.

(5) ASTM C595 Type IL(MS) or IT(MS) plus High-Reactivity Pozzolan where the blend has less than 0.10 percent expansion at 18 months when tested according to ASTM C1012.

(6) ASTM C595 Type IP(HS), IL(HS) or IT(HS) having less than 0.10 percent expansion at 18 months when tested according to ASTM C1012. Class F fly ash, slag cement, or High-Reactivity Pozzolan may be substituted for Type IL cement. Class C fly ash shall not be substituted for cement.

(7) ASTM C595 Type IL with a minimum of a 20 percent substitution of Class F fly ash or slag cement by weight, where the blend has less than 0.10 percent expansion at 18 months when tested according to ASTM C1012.

(8) ASTM C150 Type I, II, III or V plus a minimum of 20% Class F fly ash when the R factor of the fly ash is less than 0.75. R factor is determined using the following from the chemical composition of the fly ash.

 

In subsection 601.04, the last paragraph shall include the following:

ASTM C1012 test results are acceptable for up to two years from the completion date of the test.

In subsection 601.05, first paragraph, delete the sixth (last) sentence and replace it with the following:

When determining the w/cm, the weight of cementitious material (cm) shall be the sum of the weights of the cement, slag cement, fly ash, silica fume, and high-reactivity pozzolan.

In subsection 601.05 delete the fifteenth through twenty-second paragraphs and replace them with the following:

The Concrete Mix Design Report shall include certified test reports showing that the cement, fly ash, slag cement, high-reactivity pozzolan, and silica fume meet the specification requirements and shall support this statement with actual test results. The certification for silica fume shall state the solids content if the silica fume admixture is furnished as slurry.

For all concrete mix designs with ASTM C150 cements, up to a maximum of 20 percent Class C fly ash, 30 percent Class F fly ash, or 30 percent high-reactivity pozzolan by weight of total cementitious material may be substituted for cement. Up to a maximum of 50% slag cement by weight of total cementitious material may be substituted for cement. When slag cement and pozzolans are substituted for cement, the total substitution of cement shall not exceed 50% by weight of total cementitious material.

For all concrete mix designs with ASTM C595 Type IL cements, up to a maximum of 20 percent Class C fly ash, 30 percent Class F fly ash, or 30 percent high-reactivity pozzolan by weight of total cementitious material may be substituted for cement. Up to a maximum of 50% slag cement by weight of total cementitious material may be substituted for cement. When slag cement and pozzolans are substituted for cement, the total substitution of cement shall not exceed 50% by weight of total cementitious material.

For all concrete mix designs with ASTM C595 Type IP, IP(MS), IP(HS) or IT cements: fly ash or high-reactivity pozzolan shall not be substituted for cement.

For all concrete mix designs with ASTM C595 IT cements: slag cement shall not be substituted for cement.

For all concrete mix designs with ASTM C595 Type IP, IP(MS), IP(HS) cements, when slag cement is substituted for cement, the total substitution of cement shall not exceed 50% by weight of total cementitious material.

For all concrete mix designs with ASTM C1157 cements, the total pozzolan content including pozzolan in cement shall not exceed 30 percent by weight of the cementitious material content. Up to a maximum of 30% slag cement by weight of total cementitious material may be substituted for cement.

The Contractor shall submit a new Concrete Mix Design Report meeting the above requirements when a change occurs in the source, type, or proportions of cement, slag cement, fly ash, high-reactivity pozzolan, silica fume, or aggregate. When a change occurs in the source of approved admixtures, the Contractor shall submit a letter stamped by the Concrete Mix Design Engineer approving the changes to the existing mix design. The change shall be approved by the Engineer prior to use.

Delete 601.17(g) and replace it with the following:

(g) *Water to Cementitious Material Content (w/cm) Ratio.* When a non-standard concrete is used the maximum w/cm ratio is the w/cm ratio that was used in the in the laboratory trial mix for the Concrete mix design except when an optimized gradation is the only deviation from the Standard Class B, Class BZ, Class D, Class DT, Class E, and Class P concrete requirements. The w/cm ratio shall be determined for each batch of non-standard concrete by the Contractor and provided to the Engineer for approval prior to placement. If an adjustment to the mix is made after the Engineer’s approval, the w/cm shall be determined and submitted to the Engineer prior to the continuation of placement. Any non-standard concrete that is placed without the Engineer’s approval shall be removed and replaced at the Contractor’s expense.

In subsection 701.01, the third paragraph shall include the following:

ASTM C595 Type IL(MS)

ASTM C595 Type IL(HS)

ASTM C595 Type IT(MS)

ASTM C595 Type IT(HS)

Add subsection 701.05 as follows:

**701.05 Slag Cement** Slag cement shall conform to the requirements of ASTM C989. Slag cement shall be Grade 100 or Grade 120. Slag cement shall have a maximum Aluminum Oxide content of 11.0%

Slag cement shall be from a pre-approved source listed on the Department’s Approved Products List.

Slag Cement shall be subject to sampling and testing by the Department. Test results that do not meet the physical and chemical requirements may result in the suspension of the use of Slag Cement until the necessary corrections have been taken to ensure that the material conforms to the specifications.

Subsection 711.03 shall include the following:

Corrosion inhibiting admixtures shall conform to the requirements of ASTM C1582.

Pigments for integrally coloring concrete shall conform to the requirements of ASTM C979.