



June 16, 2022

**MEMORANDUM:** Fly Ash Shortage and Concrete Mixture Designs

**Background:**

The department is aware that fly ash supplies have become tighter than anticipated for this construction season. The source of this shortage is related to maintenance of coal-fired power plants. As a result, fly ash supplies are lower than anticipated and the duration of the shortage is undetermined. The need for reevaluation of accepted concrete mixture designs may be necessary if the mixture is using fly ash as its primary supplementary cementitious material (SCM).

**Benefits of Fly Ash:**

Fly ash used in concrete provides a plethora of benefits for Portland cement concrete. It increases the workability, increases resistance to fluid penetration (water), increases resistance to deicing salts and improves other properties of concrete. Absence or elimination of this SCM from concrete will negatively impact overall performance, which will require increased maintenance during the concrete's service life. The department wants to stress the importance of SCMs, like fly ash, for the longevity provided to concrete infrastructure.

**Handling Fly Ash Changes to previously submitted Concrete Mix Designs:**

This fly ash shortage may trigger a reassessment of concrete mixture designs that are currently being used on projects. Guidance on how to handle changes to concrete mixture designs incorporating fly ash are listed below for contracts under the 2022 and 2021 Standard Specifications, respectively. *Review all options prior to selecting:*

**Contract under 2022 Specification Requirements:**

**A. General (Class I, II, & III)**

1. Amend Quality Management Plan to reflect appropriate changes. (ie: source change, mix modification or new mix design)
2. Source Change Requirements:
  - a. Provide all required certifications for new sources.
  - b. New lots and sublots not required.
3. Mix Modification Requirements (allowed if meets requirements of Standard Spec 710.4(4)):
  - a. Provide updated Mix Design Form from the original submittal to reflect the changes to the mix design (ie: sources, quantities)
  - b. Generate new Contractor Mix ID and MRS Mix ID (132 report prefix). Examples:
    - 802516-FArate
    - 802516-FAsource
  - c. Provide all required certifications for new sources.
  - d. Create new lots and sublots for the modified mixture design.
  - e. New trial batching is not required.
  - f. Altering the following parameters requires a new mix design submittal, see #4 below:
    - Total cementitious content
    - Cement source
    - Aggregate source (aggregate quantities are allowed to be adjusted when changing fly ash quantity)
    - Chemical Admixture manufacturer and product name
4. New Mix Design Requirements:
  - a. Follow "Concrete Mix Design 2022 Construction Season Requirements" Memo dated March, 28, 2022. Link to memo: <https://wisconsindot.gov/Documents/doing-bus/eng-consultants/cnsit-rsrcs/tools/qmp/Mix-design-memo.pdf>
  - b. New trial batching is required.
  - c. Altering the following parameters requires a new mix design submittal:
    - Total cementitious content
    - Cement source
    - Aggregate source
    - Chemical Admixture manufacturer and product name
5. If contractor is proposing an option NOT listed below, Region will contact BTS-Concrete Unit.

**B. Class I (pick one of the following options):**

1. Reduction in Fly Ash Replacement Rate

- a. A change in replacement rate is considered a mixture modification.
  - i. Must maintain minimum replacement rate of 15% (Standard Spec 501.3.2.2.2).

2. Change Fly Ash Source (same class):

- a. Class C Fly Ash (*Pavements & Cast-In-Place Barrier*)
  - i. Changing from Class C of one source to Class C of another source is considered a source change per Standard Spec 715.3.1.2.1(1).
- b. Class C Fly Ash (*Structures*)
  - i. Changing from Class C of one source to Class C of another source is considered a mixture modification.
- c. Class F Fly Ash
  - i. Changing from a Class F fly ash on the department's APL to a Class F fly ash not on the department's APL is considered a mix modification. The replacement rate must reduce to 15% if current mixture is above 15% per Standard Spec 501.2.4.2.2.3 (2).
  - ii. Changing from a Class F fly ash on the department's APL to a Class F fly ash to another source on the department's APL is considered a source change. Replacement rate can also change within this mix modification.

3. Change in SCM Type

- a. Change in SCM type is considered a new mix design.
  - i. Trail batching **is** required.
- b. Possible SCM changes include:
  - i. Class C fly ash to Class F fly ash or vice versa.
  - ii. Fly ash (any class) to slag
  - iii. Fly ash (any class) to silica fume
  - iv. Fly ash (any class) to another SCM allowed under Standard Spec 501.2.4.2

**C. Class II and Class III (select appropriate contractual requirement):**

1. If contractually required to use 15% to 30% SCM replacement (*2022 spec*):

- a. Must follow the 15% minimum SCM requirement per Standard Spec 501.3.2.2.2.
- b. Allowed to follow any option under Class I concrete.

2. If contractually required to use 0% to 30% SCM replacement (*per ASP 6 or signed CCO*):

- a. Allowed to follow any option under Class I concrete.

## **Contract under 2021 Specification Requirements**

**A. General (Class I, II, & III)**

1. Amend Quality Management Plan to reflect appropriate changes. (ie: source change, mix modification or new mix design)

2. Source Change Requirements:

- a. Provide all required certifications for new sources.
- b. New lots and sublots are not required.

3. Mix Modification Requirements (allowed if meets requirements of Standard Spec 710.4(5)):

- a. Provide updated Mix Design Form from the original submittal to reflect the changes to the mix design (ie: sources, quantities)
- b. Generate new Contractor Mix ID and MRS Mix ID (132 report prefix). Examples:
  - 802516-FArate
  - 802516-FAsource
- c. Provide all required certifications for new sources.
- d. Create new lots and sublots for the modified mixture design.
- e. New trial batching is not required.
- f. Altering the following parameters requires a new mix design submittal, see #4:
  - Total cementitious content
  - Cement source
  - Aggregate source (aggregate quantities are allowed to be adjusted when changing fly ash quantity)
  - Chemical Admixture manufacturer and product name

4. New Mix Design Requirements:
  - a. Class I
    - i. Submit new mix design along with required WS5014 Concrete Mix Design Certification
    - ii. Trial batching is required.
  - b. Class II & Class III
    - i. Submit new mix design and required documentation.
  - c. Altering the following parameters requires a new mix design submittal:
    - Total cementitious content
    - Cement source
    - Aggregate source
    - Chemical Admixture manufacturer and product name
5. If contractor is proposing an option NOT listed below, Region will contact BTS-Concrete Unit.

**B. Class I (pick one of the following options):**

1. Reduction in Fly Ash Replacement Rate
  - a. Pavements and Cast-In-Place Barrier
    - i. A change in replacement rate is considered a mixture modification.
  - b. Structures
    - i. A change in replacement rate will be considered a mixture modification.
      - Must maintain minimum replacement rate of 15% per Standard Spec 715.2.3.2(2).
2. Change in Fly Ash Source (same class):
  - a. Class C Fly Ash (*Pavements and Cast-In-Place Barrier*)
    - i. Changing from Class C of one source to Class C of another source is considered a source change per Standard Spec 7115.3.1.2.1(1).
  - b. Class C Fly Ash (Structures)
    - i. Changing from Class C of one source to Class C of another source is considered a mixture modification.
  - c. Class F Fly Ash
    - i. Changing from Class F of one source on the department's APL to Class F of another source on the department's APL is considered a source change.
    - ii. Changing from an APL Class F ash to a non-APL Class F ash is not allowed per Standard Spec 501.2.6.3.
3. Change in SCM Type
  - a. Change in SCM type will be considered a new concrete mixture.
    - i. Trial batching **is** required.
  - b. Possible SCM changes include:
    - i. Class C fly ash to Class F fly ash or vice versa
    - ii. Fly ash (any class) to slag
    - iii. Fly ash (any class) to silica fume
    - iv. Fly ash (any class) to pozzolan

**C. Class II and Class III**

1. Allowed to follow any option under Class I concrete.