

2. Fly Ash (Class F): Allowed as a cement replacement under the following conditions:
 - a. Before replacement is made, use the minimum cement content in the design formula to establish the water/cement ratio.
 - b. Replace up to 20 percent of the cement by weight on a one (1) part fly ash to one (1) part cement basis.
 - c. Submit to ENGINEER a quality history of the fly ash identifying a minimum of 20 of the most current ASTM C618 analysis.
 3. Natural Pozzolan (Class N): Allowed as a cement replacement if the 14 day expansion test (ASTM C1567) with job aggregates, job cement and natural pozzolan does not exceed the 14 day expansion test of job aggregates, job cement and Class F fly ash.
 4. Silica Fume: Allowed as a cement replacement if replacement of hydraulic cement on a 1 part silica fume to 1 part cement does not exceed 10 percent, and water/cement ratio is established before cement is replaced with silica fume.
- E. **Selection of Mix Properties:** Select and proportion the mix to produce appropriate strength, durability and workability. Use ACI 211.1, 211.2, or 211.3, and meet the following properties and limitations:

Table 5 – Mix Properties and Limitations

| Properties | Standard | Class | | | |
|---|----------|------------|------------|------------|------|
| | | 2000 | 3000 | 4000 | 5000 |
| Compressive Strength (f_c') at 28 days, psi, minimum | C39 | 2000 | 3000 | 4000 | 5000 |
| Compressive Strength at 7 days, psi. (for reference only) | C39 | 1340 | 2010 | 2680 | 3350 |
| Average Strength, psi (f_{cr}) | 214 | (a) | (a) | (a) | (a) |
| Cement content, bags, minimum (b) | -- | 4.5 | 5.5 | 6.5 | 7.5 |
| Water-cement ratio (by weight), maximum (c) | 318 | (d) | (d) | 0.44 | |
| Entrained air, percent (based upon aggregate size) (e) | 2" | 3.0 to 6.0 | 4.5 to 7.5 | 4.0 to 7.0 | |
| | 1-1/2" | " | " | 4.5 to 7.5 | |
| | 1" | " | " | 5.0 to 7.5 | |
| | 3/4" | " | " | 5.0 to 7.5 | |
| Slump | C143 | (d) | (d) | (d) | (d) |

NOTES

- (a) The amount by which average strength (f_{cr}) exceeds compressive strength (f_c') is based upon statistical assurance that no more than 1 test in 100 tests will fall below compressive strength (f_c').
- (b) Unless allowed otherwise by ENGINEER.
- (c) Before pozzolan substitution.
- (d) Specific to exposure conditions and finishing need.
- (e) Comply with ACI 211.1 if air content is changed.
- (f) 1 bag of cement = 94 pounds.

SUPPLEMENTARY SPECIFICATION

**SECTION 03 30 04-S
CONCRETE**

Modify Table 5 "Mix Properties and Limitations" of Section 2.5 MIX DESIGN paragraph E as follows:

- A. Replace the row titled "Entrained air, percent (based on aggregate size)" with the following:

| Properties | Standard | Class | | |
|------------------------|------------|------------|------------|------------|
| | | 2000 | 3000 | 4000 |
| Entrained air, percent | ASTM C 231 | 5.0 to 7.0 | 5.0 to 7.0 | 5.0 to 7.0 |

END OF DOCUMENT

SUPPLEMENTARY SPECIFICATION

SECTION 03 30 05-S CONCRETE TESTING

Delete the following reference from paragraph 1.2 B:

C42 Obtaining and Testing Drilled Cores and Sawed Beams of Concrete

Add the following to Paragraph 1.6 ACCEPTANCE:

- C. Final Acceptance of Test Results:
 - 1. Only test results from on-site materials sampling activities conducted at the time of concrete placement will be considered for acceptance.

Delete the following subsection from Section 3.2 CAST-IN-PLACE PRODUCTS:

A 2. Core Samples, ASTM C42.

Replace Paragraph 3.3 RETESTING DEFECTIVE CONCRETE STRENGTH in its entirety with the following:

3.3 RETESTING DEFECTIVE CONCRETE

- A. If CONTRACTOR desires to re-test concrete, a written request shall be made to the ENGINEER within 35 days from the date of concrete placement. If approved, sampling shall be completed by the 40th day after placement. If approved by the ENGINEER, the following requirements shall apply:
 - 1. Sampling and analysis expenses shall be the sole responsibility of the CONTRACTOR.
 - 2. Six inch (6") diameter core samples shall be obtained from three (3) test locations which are mutually agreed upon by CONTRACTOR and ENGINEER. Locations shall be identified such that the location of quantity of concrete represented in the failed test is agreed upon as being verified.
 - 3. Improvements which contain sampling locations shall be removed to the nearest construction joint and replaced with new work.
- B. No sampling or re-testing will be allowed after 40 days (post-placement), and the substandard work shall be removed and replaced at the CONTRACTOR'S expense.
- C. The following testing protocols shall apply:
 - 1. For Deficient Entrained Air: Petrographic Analysis
 - 2. For Deficient Compressive Strength: Average compressive strength of the three (3) samples.