

## **Materials Specification – 20 for NORMAL WEIGHT AND PRECAST CONCRETE**

### **1. CONCRETE MIX SUBMITTAL:**

A minimum of 10 days prior to beginning concrete work, concrete mix designs shall be submitted, in accordance with ACI 301, for approval by Denver Water. No changes shall be made in the amounts or sources of the approved mix ingredients without the written approval of Denver Water. Production inspection and field testing of the approved mix may be made by Denver Water.

### **2. CONCRETE PRODUCTS:**

#### **A. Cementitious Materials:**

1) Cement

All Cement used shall be Type II Portland cement which shall conform to the requirements of ASTM C150.

2) Fly Ash

Fly ash may be used in the concrete mixes. The amount of fly ash shall be 15% by weight of the total cementitious materials. Fly ash additions to the mix will be on a cement substitution basis; fly ash shall conform to ASTM C618.

#### **B. Aggregates:**

1) Fine Aggregate

Fine aggregate shall consist of natural sand or a blend of natural sand and crushed sand provided that the quantity of crushed sand is not more than 50% of the total sand by dry weight. Fine aggregate shall conform to the grading and quality requirements of ASTM C33.

2) Coarse Aggregate

Coarse aggregate shall consist of gravel, or crushed stone, and shall conform to the grading and quality requirements of ASTM C33 for Size No. 467, No. 57 or No. 67. Nominal maximum size of coarse aggregate shall comply with ACI 318.

If the aggregates used are known to be reactive with high alkali cement, as determined by ASTM C295, or if the reactivity of the aggregate is not known, the use of low alkali cement is required to ensure adequate protection from alkali-aggregate reaction.

#### **C. Water:**

The batch mixing water and mixer washout water shall conform to the requirements of ASTM C94.

#### **D. Admixtures:**

Calcium chloride shall not be used.

An air-entraining agent shall be used in concrete. The agent used shall conform to ASTM C260. It shall be added to the batch in accordance with ASTM C94.

Chemical admixtures that do not contain calcium chloride and conform to ASTM C494 for concrete may be used. Chemical admixtures shall be compatible with the cement and other admixtures in the batch.

Damages or difficulties that occur as a result of the use of any admixtures shall be the responsibility of the user. Denver Water will not provide any compensation for concrete because of such difficulties. Use of admixtures shall in no way relieve the responsibility for the protection and curing of the concrete.

**3. CONCRETE PROPORTIONS:**

Concrete shall be made in two classes: Class A and Class B.

Class A concrete shall have a minimum 28 day compressive strength of 4000 psi when molded and cured, in compliance with ASTM C31, and shall be used for structural and precast concrete.

Class B concrete shall have a minimum 28 day compressive strength of 2500 psi when molded and cured, in compliance with ASTM C31, and may be used for concrete kickblocks exclusively.

Concrete shall be air entrained to a total air content of 5%, plus 2% or minus 1% of the volume of the batch. The minimum slump shall be 2-inches and the maximum slump shall be 4-inches as tested in accordance with ASTM C143.

Fine aggregates shall be between 36% and 44% by volume of the total aggregates in the concrete.

**4. ENFORCEMENT OF STRENGTH REQUIREMENTS:**

Should the strengths by the laboratory cured test specimens made and tested in accordance with the provisions of the Standards and evaluated by the methods recommended in ACI 318 fall below the specified values, Denver Water shall have the right to require changes in the proportions of the concrete mix to be used on the remainder of the work.

Denver Water may require a minimum of three concrete cores to be drilled, in the manner described in ASTM C42, and tested for compressive strength, in the manner described in ASTM C39, for each portion of the work where the laboratory cured concrete test cylinders indicate a failure to meet the specified strength requirement within the specified time period.

If the results of this test do not satisfy the strength requirements of this Standard, Denver Water shall have the right to require either the strengthening or the replacement of those portions of the structure which have failed to develop the required strength.

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Normal Weight and Precast Concrete*