

## Material Specification – 20

### NORMAL WEIGHT AND PRECAST CONCRETE

#### 1. GENERAL

Normal weight and precast concrete shall be provided in accordance with ACI 301 with the following additional requirements or exceptions.

#### 2. CONCRETE MIX SUBMITTAL

A minimum of 14 days prior to beginning concrete work, concrete mix designs in accordance with ACI 301 shall be submitted for approval by Denver Water. Submittals shall include data sheets demonstrating that all mix components meet the requirements outlined in this specification. Mix design shall be signed and sealed by the PE and include historical compressive strength test results. Changes shall not be made in the amounts or sources of the approved mix ingredients without Denver Water's written approval. A Certified independent testing firm, hired by the contractor, shall take samples for testing at a minimum from the first concrete truck and every 50 cubic yards thereafter for each mix on each day. Production inspection and field testing of the approved mix may be made by Denver Water.

#### 3. CONCRETE PRODUCTS

##### A. Cementitious Materials:

- 1) Type II Portland cement in accordance with ASTM C 150.
- 2) Fly ash may be used in concrete mixes in accordance with ASTM C 618. The maximum amount of fly ash shall be 20% by weight of the total cementitious materials. Fly ash additions to the mix shall be on a cement substitution basis.

##### B. Aggregates:

- 1) Fine aggregate shall be in accordance with the grading and quality requirements of ASTM C 33.
  - a) Natural sand or a blend of natural sand.
  - b) Crushed sand provided the quantity of crushed sand is no more than 50% of the total sand by dry weight.
- 2) Coarse aggregate shall be in accordance with the grading and quality requirements of ASTM C 33 for Size No. 57, No. 67, or No. 467.
- 3) Aggregates shall be tested for alkali reactivity in accordance with ASTM C 1260. A maximum of 0.10% expansion at 14 days is permitted for aggregate product used in Portland cement concrete.

##### C. Water shall be in accordance with the requirements of ASTM C 94.

##### D. Admixtures:

- 1) Admixtures that do not contain calcium chloride and are in accordance with ASTM C 494 for concrete may be used.
- 2) Admixtures shall be compatible with cement and other admixtures.
- 3) Admixtures shall be produced by one Manufacturer.
- 4) An air-entraining agent shall be used in accordance with ASTM C 260 and added to the batch in accordance with ASTM C 94.
- 5) Damages or difficulties that occur due to the use of admixtures are the responsibility of the user. Denver Water will not provide compensation for the concrete due to such difficulties. The use of admixtures shall in

no way relieve the responsibility for the protection and curing of concrete.

#### **4. CONCRETE PROPORTIONS**

- A. Class A: Minimum 28-day compressive strength of 4,500 psi when molded and cured in accordance with ASTM C 31. It shall be used for structural and precast concrete.
- B. Class B: Minimum 28-day compressive strength of 2,500 psi when molded and cured in accordance with ASTM C 31. It shall be used exclusively for concrete kickblocks.

Concrete shall be air-entrained to a total air content of 5% to 8% 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 C 143.

The maximum ratio of water to cementitious material shall be 0.45.

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

#### **5. ENFORCEMENT OF STRENGTH REQUIREMENTS**

Denver Water will have the right to require changes in the proportions of the concrete mix to be used on the remainder of the work if 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 may require a minimum of three concrete cores to be drilled in the manner described in ASTM C 42 and tested for compressive strength in the manner described in ASTM C 39 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.

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

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