

Materials Specification – 20 for 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 10 days prior to beginning concrete work, concrete mix designs in accordance with ACI 301 shall be submitted for approval by Denver Water. Changes shall not be made in the amounts or sources of the approved mix ingredients without Denver Water's written approval. Production inspection and field-testing of the approved mix may be made by Denver Water.

3. CONCRETE PRODUCTS

A. Cementitious Materials:

- 1) Cement: Type II Portland cement in accordance with ASTM C 150.
- 2) Fly Ash: Fly ash may be used in concrete mixes in accordance with ASTM C 618. 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.

B. Aggregates:

- 1) Fine Aggregate: In accordance with the grading and quality requirements of ASTM C 33. Fine aggregate shall consist of natural sand or a blend of natural and crushed sand provided the quantity of crushed sand is no more than 50% of the total sand by dry weight.
- 2) Coarse Aggregate: In accordance with the grading and quality requirements of ASTM C 33 for Size No. 467, No. 57, or No. 67. Coarse aggregate shall consist of gravel or crushed stone. The nominal maximum size of coarse aggregate shall be in accordance with ACI 318.

If the aggregates used are known to be reactive with high alkali cement as determined by ASTM C 295 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: In accordance with the requirements of ASTM C 94.

D. Admixtures: Admixtures that do not contain calcium chloride and are in accordance with ASTM C 494 for concrete may be used. Admixtures shall be compatible with cement and other admixtures.

An air-entraining agent shall be used in concrete in accordance with ASTM C 260 and added to the batch in accordance with ASTM C 94.

Damages or difficulties that occur as a result of 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 Concrete:** Minimum 28 day compressive strength of 4000 psi when molded and cured in accordance with ASTM C 31. It shall be used for structural and precast concrete.
- B. **Class B Concrete:** Minimum 28 day compressive strength of 2500 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% 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 C 143.

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 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 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 period.

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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