

SECTION ____ - GENERAL CONCRETE REQUIREMENTS

____ MATERIALS

NOTE TO SPECIFIERS: This paragraph is to be used for jobs wherein the total amount of concrete is about 100 cubic yards or less, where the features of the concrete construction are such that detailed control of the concrete operations are impracticable, and where very severe sulfates do not exist in the soil or ground water.

The Contractor shall furnish all materials for use in concrete, including cementitious materials, water, sand, coarse aggregate, and specified admixtures; and shall furnish all reinforcing bars¹(and fabric) and materials for curing concrete. Pozzolan, as specified, is an acceptable partial replacement for cement and if used shall replace 20 percent, by weight, of cement. Thirty days prior to placement of concrete, the Contractor shall submit to the Government the name and manufacturer of each cementitious materials, admixture, curing compound, and aggregate source. The Government reserves the right to require submission of manufacturer's test data and certification of compliance with specifications, and to require submission of samples of all concrete materials for testing prior to or during use in concrete.

a. Cement. - Portland cement shall meet the requirements of ASTM designation: C 150 for²(type ____) portland cement³(except that the maximum percent of tricalcium aluminate allowable in type I cement shall be 15 percent) and shall meet the low-alkali and false-set limitations specified therein. The low-alkali limitation for cement may be waived on request if the sand and coarse aggregate do not contain objectionable quantities, as determined by the Contracting Officer, of potentially alkali-reactive particles defined by mortar bar tests and complete petrographic analyses of the proposed aggregate. If the Contractor requests waiver of the low-alkali limitation, he will be required to submit petrographic analyses satisfactory to the Contracting Officer unless such analyses have been performed by the Bureau of Reclamation. The cement shall be free from lumps and contamination by water and other foreign matter when used in concrete.

b. Pozzolan. - Pozzolan shall meet the requirements of ASTM designation: C 618 for class N, F, or C with the following additional requirements:

- (1) The maximum percent of sulfur trioxide shall be 4.0 percent for classes F and C.
- (2) The maximum percent loss on ignition shall be 8.0 percent for class N and 2.5 percent for classes F and C.
- (3) The pozzolanic activity index with lime shall be determined using 2-inch cubes, and the minimum strength at 7 days shall be 900 pounds per square inch.
- (4) Unless the Contractor selects aggregates which are not potentially alkali reactive, pozzolan shall be tested for reduction or mortar expansion at 14 days as specified for

class N pozzolan under the optional physical requirements in ASTM designation: C 618. However, the cement used in the test shall be low alkali. For the pozzolan to be acceptable, it shall result in an expansion reduction of zero percent or greater when compared to the control test.

(5) Pozzolan shall not decrease the sulfate resistance of concrete. "Lassenite SR" pozzolan, as marketed by Lassenite Industries, Inc., 1475 Terminal Way, Reno NV 89502, and "Sun" pozzolan, as produced by Oregon Portland Cement Co., 111 SE. Madison, Portland OR 97214, are class N pozzolans which have been found not to detract from sulfate resistance. Class F and C pozzolans will not detract from sulfate resistance if they have an "R" factor less than 2.5. "R" is defined as $(C-5)/F$ where C is the calcium oxide content of the pozzolan in percent and F is the ferric oxide content in percent.

c. Water. - Water shall be free from objectionable quantities of silt, organic matter, salts, and other impurities.

d. Sand and coarse aggregate. - Sand and coarse aggregate shall consist of clean, hard, dense, durable, uncoated rock fragments that are free from injurious amounts of dirt, organic matter, and other deleterious substances. Sand and coarse aggregate shall meet all requirements of ASTM designation: C 33. Coarse aggregate shall conform to ASTM designation: C 33 gradings for either size No. 467 (1 1/2-inch to No. 4 United States Standard sieve) or size No. 57 (1 inch to No. 4).

e. Air-entraining admixture. - The air-entraining admixture shall conform to ASTM designation: C 260: Provided, That air-entraining admixture used with type F or G chemical admixture shall be a neutralized vinsol resin formulation. For assistance locating a supplier, the contractor may contact the Bureau of Reclamation Materials Engineering and Research Group.

f. Chemical admixture. - The Contractor may use chemical admixtures which conform to ASTM designation: C 494, type A, D, F, or G. Chemical admixtures which will introduce more than 1/10 of 1 percent chloride, by weight of cementitious materials, shall not be used in concrete for prestressed concrete, bridge decks, or concrete in which aluminum, galvanized metalwork, or other dissimilar steel is to be embedded. For assistance locating a supplier, the contractor may contact the Bureau of Reclamation Materials Engineering and Research Group.

⁴(In all other concrete, accelerator may be furnished and used during cold weather as hereinafter provided and shall conform to ASTM designation: C 494 for type C or E. In addition, if used as an accelerator, calcium chloride shall meet requirements of ASTM designation: D 98 and shall be no coarser than grade A, class 1, or shall be liquid. The portion of mixing water containing other admixtures shall not come in contact with the calcium chloride before entering the mixer.)

g. Reinforcing bars ¹(and fabric).- Reinforcing bars shall conform to ASTM designation: A 615 or A 617, grade ⁵(40 or 60), including supplementary requirements. ¹(Fabric shall be electrically welded-wire fabric conforming to ASTM designation: A 185 or A 497.)

h. curing compound. - Wax-base (type I) and water-emulsified, resinbase (type II) curing compound shall conform to the requirements of Water and Power Resources Service "Specifications for Concrete Curing Compound," dated October 1, 1980. Curing compound shall be of uniform consistency and quality within each container and from shipment to shipment.

i. Polyethylene film. - Polyethylene film for curing concrete shall be white in color, shall be 4 mils thick, and shall conform to the requirements of ASTM designation: C 171.

_____ COMPOSITION

Unless otherwise directed, the Contractor shall design the concrete mix in accordance with these specifications. Mix designs shall provide for the minimum cementitious materials contents listed in table _____ (Minimum cementitious materials content).

Table _____. - Minimum cementitious materials content

Minimum Nominal maximum size aggregate in concrete	Minimum cementitious materials content without water reducing admixture	Minimum cementitious materials content with water reducing admixture
1-1/2 inches	565 lb/yd ³	535 lb/yd ³
1 inch	620 lb/yd ³	585 lb/yd ³

Each mix design shall be submitted to the Contracting Officer for review prior to use of the concrete mix.

The Contracting Officer will test concrete for compliance with specifications and reserves the right to design and adjust the concrete mix proportions.

Air-entraining admixture shall be used in such an amount as will effect the entrainment of from 4 to 6 percent air, by volume, of the concrete as discharged at the placement.

The slump of the concrete shall not exceed 3 inches plus or minus 1 inch when placed, nor 5 inches when first mixed.

⁶(Type C or E chemical admixtures, including calcium chloride, shall not be used in concrete.)

_____ BATCHING, MIXING, AND TRANSPORTING

Concrete shall be manufactured and delivered in accordance with ASTM designation: C 94, "Standard Specifications for Ready Mixed Concrete."

When bulk cementitious materials and aggregates are dry batched and hauled to where mixing is accomplished, each batch shall be protected during transit to prevent loss and to limit prehydration of the cementitious materials. Separate compartments with suitable covers shall be provided to protect the cementitious materials, or they shall be completely enfolded in and covered by the aggregates to prevent wind loss. If cementitious materials are enfolded in moist aggregates or otherwise exposed to moisture and delays occur between batching and mixing, the Contractor shall, at its own expense, add extra cementitious materials to each batch in accordance with the schedule in table ____ (Additional cementitious materials requirements.)

Table ____ - Additional cementitious materials requirements

Hours of contact between cementitious materials and wet aggregate*	Additional cementitious materials required
0 to 2	0 percent
2 to 3	5 percent
3 to 4	10 percent
4 to 5	15 percent
5 to 6	20 percent
Over 6	Batch will be rejected

The Government reserves the right to require the addition of cementitious materials for shorter periods of contact during periods of hot weather, and the Contractor shall be entitled to no additional compensation by reason of the shortened period of contact.

____ CONCRETE PLACEMENT, CURING, AND PROTECTION

Steel reinforcing bars ¹(and fabric) shall be placed as shown on the drawings. Before reinforcement is placed, the reinforcement shall be cleaned of heavy flaky rust, loose mill scale, dirt, grease, or other foreign substances. Reinforcement shall be accurately placed and secured in position so that it will not be displaced during the placing of concrete.

Forms shall be used to shape the concrete to the required lines. Exposed unformed surface shall be brought to uniform surfaces and given a reasonably smooth, wood-float or steel-trowel finish as directed.

The temperature of the concrete when it is being placed shall be not more than 90 EF and not less than 50 EF.

The concrete shall be cured with water, curing compound, or polyethylene sheets. If water cured, the concrete shall be kept continuously moist for at least 14 days after being placed by sprinkling or spraying, or by other methods approved by the Contracting Officer. Curing compound, when used, shall be applied in accordance with the procedures contained in the Eighth Edition - 1981 Revised Reprint of the Bureau of Reclamation "Concrete Manual." Concrete cured by covering with polyethylene sheeting shall be kept continuously moist for at least 14 days after placement.

The Contractor shall protect all concrete against injury until final acceptance by the Government. The concrete shall be maintained at a temperature not lower than 50 EF for at least 72 hours after it is placed and, if water cured, shall be protected against freezing temperatures for the duration of the curing period. Then after discontinuance of the water curing, this concrete shall be maintained at a temperature of not less than 50 EF for 72 hours. Where artificial heat is employed, special care shall be taken to vent the heater and to keep the concrete from drying.

____ REPAIR OF CONCRETE

All concrete that is damaged or defective from any cause; concrete that is honeycombed, fractured, or otherwise defective; and concrete which, because of excessive surface depressions, must be excavated and built up to bring the surfaces to the prescribed lines shall be removed and replaced; and imperfections and irregularities on concrete surfaces shall be corrected. The repair of damaged or defective concrete and the correction of surface imperfections and irregularities shall be made with ⁷(concrete, dry pack, cement mortar, epoxy-bonded concrete, or epoxybonded epoxy mortar,) where and as applicable for the type of repair involved, in accordance with Bureau of Reclamation "Standard Specifications for Repair of Concrete," dated January 4, 1982: except, that epoxy-bonded epoxy-mortar shall not be used for outdoor repairs having a surface area greater than 1 square foot. The cost of furnishing all materials and performing all work required for the repair of concrete and the correction of surface imperfections and irregularities shall be borne by the Contractor.

⁸[____] PAYMENT

Payment for all concrete required under these specifications, including the cost of furnishing and placing reinforcing bars ¹(and fabric), will be made at the lump-sum price bid in the schedule for ⁸(concrete _____).

The lump-sum price bid in the schedule for ⁸(concrete _____) shall include the cost of supplying the cementitious materials quantities specified in paragraph ____ (Composition). If the Government requires the Contractor to use cement in excess of these amounts, such additional cement will be paid for in accordance with clause in subsection I.4 entitled "Changes."

⁸[____] COST

The cost of all labor and materials required for concrete under these specifications, including the cost of furnishing and placing reinforcing bars ¹(and fabric), shall be included in the lump-sum price bid in the schedule for ⁸(concrete _____).

The lump-sum price bid in the schedule for ⁸(concrete _____) shall include the cost of supplying the cement quantities specified in paragraph ____ (Composition). If the Government requires the Contractor to use cementitious materials in excess of these amounts, such additional cementitious materials will be paid for in accordance with clause in subsection I.4 entitled "Changes."]

¹Delete if fabric is not involved.

²Determine type of cement to be used.

³Include only when type I cement is specified

⁴Delete if type V cement is being specified, if the concrete is primarily for substation and transmission line foundation, or if the use of setaccelerating admixtures will otherwise be prohibited.

⁵Delete or revise as required for grade as appropriate.

⁶Use this sentence if type V cement is being specified or if use of setaccelerating admixture is otherwise prohibited. If an accelerator is to be used, delete this sentence.

⁷Delete or revise as required.

⁸Revise as required.

3-15-85 Revisions: Revised throughout.