NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE SPECIFICATION

STRUCTURE FOR WATER CONTROL, CONCRETE

CODE 587C

1. SITE PREPARATION

a. Make all excavation to planned lines and grades to adequately allow proper placement and installation at the structure.

b. Keep out or remove all water or mud from the excavated area prior to the placement of the structure.

2. CLASSES OF CONCRETE

The class of concrete to be used in the construction of this work shall be specified on the drawings.

Concrete shall be classified according to the required compressive strength as tabulated below. The strength of the concrete at 28 days shall equal or exceed the tabulated Minimum Compressive Strength at 28 days for the class of concrete specified.

Class of Concrete	Minimum Compressive Strength at 28 days (psi)
5000 M	5000
4000 M	4000
3000 M	3000
2500 M	2500

3. CONCRETE MIX

At least 5 days prior to any placement of concrete, the Contractor shall furnish to the Engineer a statement of the mix proportions (including admixtures, if any) for each specified class of concrete. The statement shall include reports of laboratory tests showing that the proportions selected will produce concrete of adequate strength and quality. In the event changes become necessary, no concrete containing new or altered materials shall be placed until the Engineer has approved the revised job mix.

When specified, mixes that include fly ash as a partial substitution for portland cement shall be based on absolute volume, with a maximum substitution of 20 percent.

4. CONCRETE MATERIALS

a. Portland cement. The cement used shall be a portland cement, Type II, or as specified on the drawings. One brand, only, of any type of cement shall be used.

b. Water. Only clean water, free from acid, alkali, oil, or organic impurities, shall be used. Generally, water suitable for drinking may be used.

c. Aggregates. Aggregates shall be clean, hard, durable particles with a maximum size of coarse aggregate of 1.5 inches and shall conform to the provisions of ASTM Designation C 3.

d. Air content and consistency. An air-entraining admixture shall be added in a portion of the mixing water. The air content shall be between 4 and 7 percent of the volume of the concrete. Unless otherwise specified, the slump shall be 2 to 4 inches.

5. MEASURING CONCRETE MATERIAL

a. Cement shall be measured by weight.
b. Aggregates shall be measured by weight.
c. Water shall be measured by weight or volume.
d. Dry admixtures shall be measured by weight, and

paste or liquid admixtures by weight or volume.

6. MIXING

a. Ready-mix. When used, ready-mixed concrete shall be mixed and delivered in conformance with ASTM Designation C 94. The concrete shall be discharged from the mixer within 1.5 hours after adding the mixing water to the cement and aggregates, or cement to aggregates. This time shall be reduced to 0.75 hour when the concrete temperature exceeds 85 degrees Fahrenheit.

b. Batchmixing at the site. For concrete mixed at the site of the work with paving mixers or stationary construction mixers, the time of mixing after all cement and aggregates are in the mixer drum shall be not less than 1.5 minutes.

The batch shall be so charged into the mixer that some water will enter in advance of the cement and aggregates and all mixing water shall be introduced into the drum before one-fourth of the mixing time has elapsed.

c. Truck-mixed concrete. When concrete is mixed in a truck mixer loaded to its maximum capacity, the number of revolutions of the drum or blades at mixing speed shall not be less than 70 nor more than 100. If the batch is at least one-half cubic yard less than maximum capacity, the number of revolutions at mixing speed may be reduced to not less than 50; and mixing in excess of 100 revolutions shall be at the speed designated by the manufacturer of the equipment as agitating speed.

The mixing operation shall begin within 30 minutes after the cement has been added to the aggregates, and the water shall be added during mixing. When mixing is begun during or immediately after charging, a portion of the mixing water shall be added ahead of or with the other ingredients.

7. INSPECTING AND TESTING

The Engineer shall have free entry to the plant and equipment furnishing concrete. Proper facilities shall be provided for the Engineer to inspect materials, equipment, and processes and to obtain samples of the concrete. All tests and inspections will be conducted so as not to interfere unnecessarily with the manufacture and delivery of the concrete.

The following tests will be performed by the methods indicated:

Test	Method (ASTM Designation)
Sampling	C 172*
Slump Test	C143*
Air Content	C231* or C173*
Compression Test Specimens	C31** or C42**
Compressive Strength	C39** or C42**
Unit Weight	C138

* Test of a portion of a batch may be made on samples representative of that portion for any of the following purposes:

(1) Determining uniformity of the batch.
(2) Checking compliance with requirements for slump and air content when the batch is discharged over an extended period of time.
(3) Checking compliance of the concrete with the specifications when the whole amount being placed in a small structure, or a distinct portion of a larger structure, is less than a full batch.

** For each strength test of specimens made according to ASTM Designation C 31, C 39, or C 42, three standard test specimens shall be made. The test result shall be the average of the strengths of the three specimens; except that if one specimen in the test group shows manifest evidence of improper sampling, molding, or testing, it shall be discarded and the strengths of the remaining two specimens shall be averaged. Should more than one specimen in a test group show such defects, the entire group shall be discarded and additional samples shall be taken.

8. PLACING CONCRETE

a. No concrete shall be placed until the subgrade, forms, and reinforcing steel have been inspected and approved. Placement of concrete on mud, dried earth, uncompacted fill, or frozen subgrade will not be permitted.

b. Earth foundations under the structure shall be firm and damp.

c. Concrete shall be placed and worked into corners of the forms and around the reinforcing steel in such a manner as to prevent the concrete materials from segregating. Depositing of the concrete shall be so regulated that the concrete may be consolidated with a minimum of lateral movement.

d. When conditions are such that the temperature of the concrete may be expected to exceed 85 degrees Fahrenheit at the time of delivery at the work site, during placement or during the first 24 hours after placement, the contractor shall maintain the temperature of the concrete below 85 degrees Fahrenheit during mixing, conveying, and placing.

9. CONSTRUCTION JOINTS

a. Construction joints shall be made at locations shown on the drawings. If joints are needed which are not shown on the drawings, they shall be placed in locations approved by the Engineer.

b. Surfaces of construction joints shall be cleaned of all unsatisfactory concrete, laitance, coatings, stains, curing compound, or debris by washing and scrubbing with a wire brush or other means approved by the Engineer. The surface shall be kept moist for at least 1 hour prior to placing new concrete.

8. PROTECTION FROM FREEZING

Concrete shall not be placed during freezing weather unless adequate protection is provided to keep the concrete temperature between 50 and 90 degrees Fahrenheit for a period of not less than 7 days.

9. REMOVAL OF FORMS

Forms shall be removed in such a way as to prevent damage to the concrete. Supports shall be removed in a manner that will permit the concrete to take the stresses due to its own weight uniformly and gradually.

Forms shall not be removed sooner than the following minimum times after the concrete is placed. These periods represent cumulative number of days and fractions of days, not necessarily consecutive, during which the temperature of the air adjacent to the concrete is above 50 degrees Fahrenheit.

Element	Time
Beams, arches – supporting forms and shoring	14 days
Conduits, deck slabs – supporting (inside) forms and shoring	7 days
Conduits (outside forms), sides of beams, small structures, gabion capping	24 hours
Columns, walls, spillway risers – with side or vertical load	7 days
Columns, walls, spillway riser – with no side or vertical load: Concrete supporting more than 30 feet of wall in place above it	7 days
Concrete supporting 20 to 30 feet of wall above it*	3 days
Concrete supporting not more than 20 feet of wall in place above it*	24 hours

*Age of stripped concrete shall be at least 7 days before any load is applied other than the weight of the column or wall, forms, and scaffolds for succeeding lifts.

12. FINISHING

Concrete surfaces shall be true and even and shall be free from open or rough spaces. Defective concrete, honeycombed areas, and voids left by removal of tie rods shall be repaired immediately after the removal of forms. Defective concrete

shall be repaired by cutting out unsatisfactory material and placing new concrete secured by anchors in the repair area. Patching mortar for tie rod holes, etc., shall be thoroughly compacted into place to form a dense, well-bonded unit. All unformed areas of concrete exposed in the complete work shall have a float finish.

13. CURING

All concrete shall be cured for a period of not less than 7 days. Concrete may be moist-cured by maintaining all surfaces continually wet for the duration of the curing period. At the option of the Contractor and approval of the Engineer, the concrete may be cured using a curing compound conforming to ASTM Designation C 309. The curing compound shall be applied at a rate of not less than 1 gallon per 150 square feet of surface. Only white pigmented compounds shall be used. Exposed surfaces shall have the compound applied as soon as the free water has disappeared. Formed surfaces shall have the compound applied immediately after the forms are removed and defective areas repaired.

14. STEEL REINFORCEMENT

a. Details of construction. The reinforcing steel shall be deformed reinforcing bars of the size and spacing as shown on the drawings. The bars shall have a minimum of 2 inches concrete cover for formed and top surfaces and 3 inches for concrete placed against the earth.

b. Bending and splicing. Reinforcing steel may be mill or field bent. All bends shall be made without heating.

c. Splicing. The splices shall be at least 30 diameters of the smaller bar being spliced, but not less than 12 inches.

d. Support. All reinforcing bars must be securely tied and supported in their proper location with wire, patented clips, or chair supports before concrete placement begins. Bars assembled in place in horizontal mats must be tied at each intersection around the periphery of the mat and at least at every fourth bar within the mat. Horizontal bars placed in the vertical mats should be tied in at least three locations for each length or at every third intersection, whichever results in closer spaced ties. If mats are preassembled, they should be adequately tied so they remain rigid during handling and placement. Tieing by use of spot welding is not permitted.

e. Placing. All reinforcing steel shall be placed in the structure as shown on the drawings (steel details). Bars shall be free of loose, flaky rust and scale, oil or grease, or other material that may reduce the bond with the concrete.

15. BACKFILL

Backfill shall be placed carefully against all indicated portions of the works so as not to disturb the finished structure. No backfill or other load will be placed against concrete surfaces prior to 72 hours after removal of the forms. Compaction will be by hand tamping, hand operated mechanical tampers, or other methods approved by the Engineer. Earth backfill shall be moist enough to form a tight ball when squeezed in the hand, and shall be placed in horizontal layers not exceeding 6 inches in thickness before compaction. Maximum size of rock in the backfill shall not exceed 2 inches.

16. DISPOSAL OF MATERIAL

Any excavated material not needed or designated as not suitable for backfill shall be disposed of by placing it in a neat, workmanlike manner in locations designated by the Engineer.

17. MEASUREMENT

Measurement of concrete will be made on the basis of the actual volume of concrete within the neat lines of the structure as

indicated on the drawings, and will be computed to the nearest one-tenth cubic yard.