

CONSTRUCTION SPECIFICATION

NV-32. REINFORCED CONCRETE FOR MINOR STRUCTURES

1. SCOPE

The work shall consist of forming, placing, finishing, and curing portland cement concrete and the furnishing and placing of reinforcement for small noncritical reinforced concrete structures, generally less than 10 cubic yards.

2. MATERIALS

- A. Portland cement shall conform to ASTM C 150 and shall be Type IP(MS), II, IIA, or V.
- B. Fine aggregate shall conform to ASTM C 33 and be composed of clean, uncoated grains of material.
- C. Coarse aggregates shall be gravel or crushed stone conforming to ASTM C 33 and be clean, hard, durable, and free from clay or coating of any character.
- D. Water shall be clean and free from injurious amounts of oil, salt, acid, alkali, organic matter, or other deleterious substances.
- E. Air entraining agent shall conform to ASTM C 260.
- F. Reinforcing steel for concrete shall meet the requirements of ASTM A 615. The steel shall be deformed Grade 40 or Grade 60 billet-steel bars unless otherwise noted on the plans.
- G. Fiber Reinforcing shall be homopolymer polypropylene conforming to ASTM C 1116 for Type III Synthetic Fiber Reinforced Concrete.
- H. Curing compound shall be a liquid membrane-forming compound suitable for spraying on the concrete surface. The curing compound shall meet the requirements of ASTM C 309 Type 2 (white pigmented).

3. DESIGN OF THE CONCRETE MIX

The concrete mix shall provide a minimum 28-day compressive strength of 3000 psi. The mix shall contain not less than 5.5 sacks of cement per cubic yard and not more than 6 gallons of water per sack of cement including the moisture in the aggregates. Air entrainment shall range from 4% to 8%. Slump shall be 2 to 5 inches.

The fine aggregate oven dry weight shall be 30-45 percent of the total oven dry weight of the combined aggregates.

The maximum size coarse aggregate shall not exceed 1 inch for concrete thickness of 4 inches or less and 1½ inches for concrete thickness of 4 inches or more.

The Contractor shall be responsible for determining the design mix proportions and shall provide a copy of the mix for approval to the Technician at least 3 days prior to placing any concrete. A concrete batch ticket shall be supplied to the Technician at the time of placement. The minimum information to be included shall be the name of the supplier, size of load, time of loading, type and amount of cement, type and amount of admixtures, saturated surface dry weights of fine and coarse aggregates, mixing water at the plant and free water in aggregates.

If specified, fiber reinforcing shall be added to the mix at the rate of 1.5 pounds per cubic yard.

Ready-mixed concrete shall be batched, mixed and transported in accordance with ASTM C 94.

The concrete shall be batched and mixed such that the temperature of the concrete at time of placing shall not be less than 50°F or more than 90°F.

4. REINFORCING STEEL

Reinforcing steel shall be free from loose rust, oil, grease, paint, or other deleterious matter.

Reinforcement shall be accurately placed as shown on the drawings and secured in position in a manner that will prevent its displacement during the placement of concrete. Metal chairs, metal hangers, metal spacers, or concrete chairs shall be used to support the reinforcement. Precast concrete chairs shall be manufactured from concrete equal in quality to the concrete being placed. Precast concrete chairs shall be moist at the time concrete is placed.

Splices of reinforcing bars shall be lapped 30 diameters but not less than 12 inches. Bars shall not be spliced by welding.

5. FIBER REINFORCEMENT

Polypropylene fiber reinforcement fibers may be used for non-structural concrete in lieu of temperature and shrinkage steel in non-structural slabs on grade, canal linings, cutoff collars, thrust blocks and other locations where there is non-structural steel is required.

6. FORMS FOR CONCRETE

Forms shall be made of wood, plywood, or metal. The form surfaces are to be clean and free from holes and other irregularities. The type, size, shape, quality and strength of forms are to be approved by the Technician. The forms shall be moist when the concrete is placed. Forms shall be mortar tight and non-yielding. All formwork shall be in place for at least 24 hours after concrete placement.

Metal ties that break off below the surface of the concrete shall have removable cones that permit their removal without damage to the concrete.

7. PLACING CONCRETE

Concrete shall not be placed until the subgrade, forms, and steel reinforcement have been inspected and approved by the Technician. Any deficiencies are to be corrected before the concrete is delivered for placement.

Concrete shall be delivered to the site and discharged into the forms within 1-1/2 hours after the introduction of the cement to the aggregates and shall be consolidated by spading or mechanical vibration. In hot weather or under conditions contributing to quick stiffening of the concrete, discharge of the concrete shall not exceed 45 minutes unless a set-retarding admixture is used or the mix is remaining workable.

Concrete shall be uniform and thoroughly mixed when delivered to the forms.

Upon arrival at the job site, addition of water will be allowed to adjust the slump, provided such addition does not exceed the specified limits of the slump or maximum water content contained in the design mix. Final placement of the batch shall begin immediately after mixing of the added water is completed. No additional water shall be added to the mix after placement has begun.

All concrete placed on earth shall be placed on clean firm damp surfaces, free of frost, ice, running water, or mud.

Concrete shall be placed at air temperatures between 40°F and 80°F, unless special measures are taken to protect the concrete. Concrete shall be protected from freezing for 7 days after placement.

Concrete shall not be dropped more than 5 feet vertically unless suitable equipment is used to prevent segregation.

Uniformed exposed surfaces in the completed work shall have a wood float or broomed finish. Concrete edges shall be chamfered $\frac{3}{4}$ inch or finished with molding tools.

8. JOINTS

Install joints as shown on the drawings. A formed construction joint shall be made at the locations shown on the drawings, at the end of the day, or at any time when a cold joint would occur.

Control joints are required every 8 to 12 feet in both directions, unless otherwise shown on the drawings. They shall be tooled or sawed to a depth of $\frac{1}{4}$ of the slab thickness.

9. FINISHING

After the concrete has been consolidated, the unformed surfaces shall be given a wood float finish. Immediately after form removal, formed surfaces shall be cleaned of all defective concrete and effectively repaired. Snap ties shall be removed and the holes mortared.

10. CURING CONCRETE

Concrete shall be prevented from drying for a period of at least 7 days. Curing shall be accomplished by covering with continuously moistened material or by use of an approved white pigmented curing compound in accordance with the manufacturer recommendations. The concrete shall be cured for at least 7 days before placement of backfill.

If conditions warrant, concrete shall be protected from freezing for a least 7 days after placement. Concrete damaged by freezing shall be considered as not meeting these specifications and must be removed and replaced.

11. BASIS OF ACCEPTANCE

The acceptability of the reinforced concrete shall be determined by inspection to check compliance with all the provisions of this specification, with respect to the drawings, and the minimum installation requirements.

Materials used shall be certified as meeting the requirements of this specification. The installing Contractor shall certify that the installation complies with the requirements of this specification. A written guarantee shall be furnished that protects the Owner against defective workmanship and materials for no less than one year.