

Reinforced Concrete for Minor Structures

1. SCOPE

These volumetric batching or ready mix procedures may only be used for small, non-critical structures, generally less than 5 cubic yards in size, when specifically authorized by the Technician.

The work shall consist of furnishing and placing steel reinforcement, furnishing, forming, placing, finishing and curing portland cement concrete as shown on the drawings and in accordance with these specifications.

2. MATERIALS

Steel – Steel reinforcement shall be commercial reinforcing steel specifically manufactured for use as concrete reinforcement. Deformed bars or wire mesh shall be at least the minimum size specified on the drawings. All reinforcement shall be free from flaking rust, oil, grease, paint, or other deleterious matter.

Portland Cement – Portland cement shall conform to the requirements of ASTM Specification C-150 for the specified type. If a type is not specified, Types I, II, or III may be used. Unless otherwise specified, concrete shall be air-entrained by adding an air-entraining admixture in accordance with ASTM C-260 at the mixer or by using an air-entraining cement, Types IA, IIA, or IIIA.

Aggregates – Unless otherwise specified, the concrete mixture shall be designed to use a maximum size coarse aggregate of 1-1/2 inches. Concrete aggregates shall conform to the requirements of ASTM C-33. Where aggregates conforming to these specifications are not obtainable, aggregates that have been shown by tests or by actual

service to produce concrete of the required strength, durability, watertightness, and wearing qualities may be used if authorized by the Technician. Aggregates approved for use by the Montana Highway Department are acceptable.

Water – Water used in mixing shall be reasonably clean, free from objectionable quantities of sediment, organic matter, salts, or other impurities.

Add Mixtures – Only air entrainment admixtures conforming to ASTM C-260 are recognized for use.

3. PLACING STEEL REINFORCEMENT

Bar bends shall be made without heating. The length of splices of reinforcing bars shall be as shown on the drawings. When not shown on the drawings, the length of splices shall provide an overlap equal to at least 36 diameters of the smaller bar spliced, but not less than 12 inches. Welded wire fabric shall be spliced by lapping not less than 6 inches with the lapped ends being securely clipped or wired together with wire ties or standard clips placed at intervals of 18 inches.

All reinforcement shall be clear of earth contact and secured in place by use of approved metal or concrete supports. The reinforcing material shall be so supported and wired together that it will remain in place during placement of concrete.

4. PROPORTIONING THE CONCRETE MIX

VOLUMETRIC BATCHING

The proportioning of cement, sand and gravel, and water should be such as to

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produce a workable concrete mixture (neither too sandy nor too harsh), with no more water in the mixture than is necessary to create the required degree of plasticity for proper handling and consolidation. A proper mix will work readily into the corners and angles of the forms and around reinforcement when consolidated, but will not segregate or exude free water during consolidation.

All materials used in the batch mixture should be carefully measured by weight or by volume.

Water is conveniently measured by volume in containers marked off in gallons and half-gallons.

Sand and gravel may be measured by volume in a 1 cubic foot bottomless box or other known volume containers.

Portland cement is usually measured in sacks, each sack containing 94 pounds of cement or approximately 1 cubic foot.

Calcium chloride or other corrosive accelerators shall not be used unless otherwise specified.

A recommended concrete mixture is as follows: one sack of portland cement to 2 cubic feet of sand to 3.5 cubic feet of gravel. If moderately moist sand and gravel (the usual condition) is used, then the amount of water to be added should be approximately 4.6 gallons per sack of regular cement or 4.1 gallons per sack of air-entrained cement.

Change proportions of aggregate slightly if necessary to get workable mixes. Do not change proportions of water to cement unless moisture content in the aggregates is extremely high or low. In no case shall the water/cement ratio exceed 5.5 gallons of

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water per sack of cement. Slump cone tests should range from 3 to 5 inches.

READY MIX

Concrete shall be proportioned by Option C, ASTM C-94. Cement and strength requirements shall be in accordance with Table 1 of this specification.

Unless otherwise specified in the special provisions, compressive strength shall be 4000 pounds per square inch and air-entrainment shall be included.

Calcium chloride or other corrosive accelerators shall not be used unless otherwise specified.

Unless otherwise specified, the slump shall be 3 to 5 inches. Air content by volume shall be 5-7% of the volume of concrete.

The proportioning of cement, sand and gravel, and water shall be such as to produce a workable concrete mixture (neither too sandy nor too harsh), with no more water in the mixture than is necessary to create the required degree of plasticity for proper handling and consolidation.

5. PLACING AND CURING TEMPERATURES

Concrete shall not be mixed nor placed when the daily minimum atmospheric temperature is less than 40 degrees Fahrenheit unless facilities are provided to prevent the concrete from freezing. The use of accelerators or antifreeze compounds will not be allowed. The materials shall be free from ice, snow, and frozen lumps before entering the mixer.

TABLE 1

Compressive Strength of Concrete	Maximum Net Water Content (gallons/bag)		Minimum Cement Content (bags/cubic yard)	
	Without Air Entrainment	With Air Entrainment	Without Strength Test	With Strength Test
3000	7	6	6	5
4000	6	5	6.5	6

Note: A bag of cement weighs 94 pounds.

5. PLACING AND CURING TEMPERATURES (continued)

Concrete, when deposited in the forms during cold weather, shall have a temperature of not less than 50 degrees Fahrenheit nor more than 90 degrees Fahrenheit. Concrete shall not be deposited on frozen ground nor in forms containing ice or frost. The air in contact with new concrete shall be maintained at temperatures between 50 degrees Fahrenheit and 70 degrees Fahrenheit for at least the first 3 days.

In hot weather, the Contractor shall apply effective means to maintain the temperature of the concrete below 90 degrees Fahrenheit during mixing, conveying, and placing.

Subgrade and forms shall be moistened prior to placing concrete.

6. CURING CONCRETE

All concrete shall be cured for a period of at least 5 days by keeping all surfaces wet or by application of an approved commercial curing compound applied at a uniform rate of 1 gallon per 150 square feet.

7. ACCEPTANCE

Acceptance or rejection of concrete will be dependent upon compliance with the procedures of this specification.

8. MEASUREMENT AND PAYMENT (Used only if applicable)

For items of work for which specific unit prices are established, each item will be measured to the nearest 0.1 of a cubic yard. Payment for each item will be made at the agreed-to unit price for that item. For items of work for which specific lump sum prices are established, payment will be made at the lump sum price.

Such payment will constitute full compensation for all materials, labor, equipment, tools, and all other items necessary and incidental to the completion of the work.

Compensation for any item of work shown on the drawings or described in the special provisions but not listed on the bid schedule will be considered incidental to and included in the pay items listed on the bid schedule.