
Standard Specification for Ready-Mixed Concrete

AASHTO Designation: M 157-24

Technically Revised: 2024

Editorially Revised: 2024

Technical Subcommittee: 3b, Fresh Concrete



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1. SCOPE

- 1.1. This specification covers ready-mixed concrete manufactured and delivered to a purchaser in a freshly mixed and unhardened state as hereinafter specified. Requirements for quality of concrete shall be either as hereinafter specified or as specified by the purchaser. In any case where the requirements of the purchaser differ from those in this specification, the purchaser’s specification shall govern. This specification does not cover the placement, consolidation, curing, or protection of the concrete after delivery to the purchaser.
- 1.2. The values stated in SI units are the preferred standard. The values given in parentheses are for information only.
- 1.3. As used throughout this specification the *manufacturer* shall be the contractor, subcontractor, supplier, or producer who furnishes the ready-mixed concrete. The *purchaser* shall be the specifying agency and designated representatives thereof. The *engineer* shall be interpreted to mean the designated representative of the specifying agency.

2. REFERENCED DOCUMENTS

- 2.1. *AASHTO Standards:*
 - M 6, Fine Aggregate for Hydraulic Cement Concrete
 - M 80, Coarse Aggregate for Hydraulic Cement Concrete
 - M 85, Portland Cement
 - M 154M/M 154, Air-Entraining Admixtures for Concrete
 - M 194M/M 194, Chemical Admixtures for Concrete
 - M 195, Lightweight Aggregates for Structural Concrete
 - M 240M/M 240, Blended Hydraulic Cement
 - M 295, Coal Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
 - M 302, Slag Cement for Use in Concrete and Mortars
 - M 307, Silica Fume Used in Cementitious Mixtures
 - R 60M/R 60, Sampling Freshly Mixed Concrete
 - R 100M/R 100, Making and Curing Concrete Test Specimens in the Field
 - T 22M/T 22, Compressive Strength of Cylindrical Concrete Specimens
 - T 105, Chemical Analysis of Hydraulic Cement
 - T 106 M/T 106, Compressive Strength of Hydraulic Cement Mortar (Using 50-mm or 2-in. Cube Specimens)
 - T 119M/T 119, Slump of Hydraulic Cement Concrete

- T 121M/T 121, Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
- T 131, Time of Setting of Hydraulic Cement by Vicat Needle
- T 152, Air Content of Freshly Mixed Concrete by the Pressure Method
- T 196M/T 196, Air Content of Freshly Mixed Concrete by the Volumetric Method
- T 290, Determining Water-Soluble Sulfate Ion Content in Soil

2.2. *ASTM Standards:*

- C567/C567M, Standard Test Method for Determining Density of Structural Lightweight Concrete
- C1157/C1157M, Standard Performance Specification for Hydraulic Cement
- C1602/C1602M, Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete
- C1603, Standard Test Method for Measurement of Solids in Water
- C1797, Standard Specification for Ground Calcium Carbonate and Aggregate Mineral Fillers for Use in Hydraulic Cement Concrete
- C1866/C1866M, Standard Specification for Ground-Glass Pozzolan for Use in Concrete
- D512, Standard Test Methods for Chloride Ion in Water
- E329, Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection

2.3. *American Concrete Institute Standards:*

- 211.1, Standard Practice for Selecting Proportions for Normal and Heavyweight and Mass Concrete
- 211.2, Standard Practice for Selecting Proportions for Structural Lightweight Concrete
- 305R, Hot Weather Concreting
- 306R, Cold Weather Concreting

2.4. *U.S. Government Printing Office:*

- Test for Variability of Constituents in Concrete. Designation 26 in *Concrete Manual*, 9th ed. Bureau of Reclamation, U.S. Department of the Interior, 1992

3. TERMINOLOGY

3.1. For the purpose of this specification, ready-mixed concrete is hydraulic cement concrete manufactured for delivery to a purchaser in a plastic state and delivered as hereinafter specified.

3.2. The volume of freshly mixed and unhardened concrete in a given batch shall be determined from the total mass of the batch divided by the actual mass per cubic foot of the concrete. The total mass of the batch shall be calculated either as the sum of the masses of all materials, including water, entering the batch or as the net mass of the concrete in the batch as delivered. The mass per cubic foot shall be determined in accordance with T 121M/T 121 from the average of at least three measurements, each on a different sample using a 14-L ($\frac{1}{2}$ -ft³) container. Each sample shall be taken from the midpoint of each of three different truck loads by the procedure outlined in R 60M/R 60.

Note 1—It should be understood that the volume of hardened concrete may be, or appear to be, less than expected due to waste and spillage, overexcavation, spreading forms, some loss of entrained air, or settlement of wet mixtures.

4.

MATERIALS
- 4.1.

Storage and facilities satisfactory to the engineer shall be provided at the batching plant to permit proper sampling, testing, and control of materials prior to and during use. The following specifications shall apply:
- 4.1.1.

Cement

Cement shall conform to M 85 for hydraulic cement, M 240M/M 240 for blended hydraulic cement, or ASTM C1157/C1157M for blended hydraulic cement. The engineer shall specify the type or types required. If no type is specified, the requirements of Type 1 as specified in M 85 shall apply. These different cements will produce concrete of different properties and should not be used interchangeably. Cement from different sources shall not be used interchangeably without approval of the engineer.
- 4.1.2.

Other Cementitious Materials

Cementitious materials other than cement shall meet the requirement of the following specification unless specified otherwise by the purchaser:

■ Coal Ash or Natural Pozzolans—M 295

■ Ground Granulated Blast Furnace Slag—M 302

■ Silica Fume—M 307

■ Ground Glass Pozzolan—ASTM C1866/C1866M
- 4.1.3.

Aggregates

Coarse aggregates shall conform to M 80. Fine aggregates shall conform to M 6. Lightweight aggregates shall conform to M 195
- 4.1.4.

Ground Calcium Carbonate and Aggregate Mineral Filler

Ground calcium carbonate and aggregate mineral filler shall conform to ASTM C1797.
- 4.1.5.

Water

Water shall be clear and free from injurious amounts of oil, acid, alkali, organic matter, or other deleterious substance. It shall not be salty or brackish. It shall be tested in accordance with ASTM C1602/C1602M. Water of questionable quality shall be subject to the acceptance criteria of Tables 1 and 2 or as designated by the purchaser.

Table 1—Acceptance Criteria for Questionable Water Supplies

	Limits	Test Method
Compressive strength, min percent control at 7 days	90	T 106M/T 106 ^a
Time of set, deviation from control	From 1:00 earlier to 1:30 later	T 131 ^a

^a Comparison shall be based on fixed proportions and the same volume of test water compared to control mix using water or distilled water.

Table 2—Chemical Limitations for Mixing Water

	Limits	Test Method
Chemical requirements, maximum concentration		
Chloride as $\text{Cl}^{[-]}$ expressed as a percent by weight of cement when added to the $\text{Cl}^{[-]}$ in the other components of the concrete mixture shall not exceed the following levels:		
1. Prestressed concrete	0.06%	ASTM D512
2. Conventionally reinforced concrete in a moist environment and exposed to chloride	0.10%	
3. Conventionally reinforced concrete in a moist environment but not exposed to chloride	0.15%	
4. Above ground building construction where the concrete will stay dry	No limit for corrosion	
Sulfate as SO_4 ppm ^a	3000	T 290
Alkalis as $(\text{Na}_2\text{O} + 0.658 \text{ K}_2\text{O})$, ppm	600	T 105
Totals, solids, ppm	50000	ASTM C1603

^a Wash water reused as mixing water in concrete may exceed listed concentrations of sulfate if it can be shown that the concentration calculated in the total mixing water, including mixing water on the aggregate and other sources, does not exceed the stated limits.

- 4.1.5.1. Wash water from mixer washout may be used only with the purchaser's approval. When wash water is permitted, the producer will provide satisfactory proof or data of nondetrimental effects if potentially reactive aggregates are to be used. Use of wash water will be discontinued if undesirable reaction with admixtures or aggregates occurs.
- 4.1.6. *Admixtures*—When air entrained concrete is specified and an admixture is used to secure the desired air content, the admixture shall meet the requirements of M 154M/M 154. Where it is desired to use admixtures for purposes other than entrainment of air, the admixture shall conform to the requirements of M 194M/M 194.

5. QUALITY OF CONCRETE

- 5.1. The mix design may be specified by the engineer or submitted to the engineer by the contractor for approval, or a performance based specification can be used. When specified by the engineer, it shall include the following:
- 5.1.1. Each cementitious materials content in kg/m^3 (lb/yd^3) of concrete, or equivalent units;
- 5.1.2. Designated size, or sizes, and amount by mass of aggregates;
- 5.1.3. Maximum water to cementitious materials ratio where water includes surface moisture and water in the admixture but excludes the absorption water of the aggregates;
- 5.1.4. Consistency desired at the point of delivery (see Section 6.1.1 for acceptable tolerances);
- 5.1.5. The range of air content of the concrete when air-entraining cement or an air-entraining admixture is specified. The air content shall be determined on samples taken at the point of placement; and
- 5.1.6. The type and amounts of admixture other than air-entraining agents when such admixtures are specified.
- 5.2. *When submitted by the contractor for approval by the engineer, the mix design shall be within the limitation specified for:*
- 5.2.1. Minimum cement content,