

## Standard Specification for

# Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement

AASHTO Designation: M 31M/M 31-07<sup>1</sup>

ASTM Designation: A 615/A 615M-06a



## 1. SCOPE

- 1.1. This specification covers deformed and plain carbon steel concrete reinforcement bars in cut lengths or coils. Steel bars containing alloy additions, such as with the AISI and SAE series of alloy steels, are permitted if the resulting product meets all the other requirements of this specification. The standard sizes and dimensions of deformed bars and their number designations shall be those listed in Table 1 [Table 2]. The text of this specification references notes and footnotes which provide explanatory material. These notes and footnotes (excluding those in tables and figures) shall not be considered as requirements of this specification.
- 1.2. Bars are of three minimum yield strength levels: namely, 280 MPa [40000 psi], 420 MPa [60000 psi], and 520 MPa [75000 psi], designated as Grade 280 [40], Grade 420 [60], and Grade 520 [75], respectively.
- 1.3. Hot-rolled plain rounds, in sizes up to and including 63.5 mm [2 1/2 in.] in diameter in coils or cut lengths, when specified for dowels, spirals, and structural ties or supports shall be furnished under this specification in Grade 280 [40], Grade 420 [60], and Grade 520 [75] (Note 2).  
For ductility properties (elongation and bending), test provisions of the nearest smaller nominal diameter deformed bar size shall apply. Requirements providing for deformations and marking shall not be applicable.
- 1.4. Welding of the material in this specification should be approached with caution since no specific provisions have been included to enhance its weldability. When the steel is to be welded, a welding procedure suitable for the chemical composition and intended use or service should be used. (Note 1).  
**Note 1**—The use of the latest edition of ANSI/AWS D1.4 is recommended for the welding of reinforcing bars. This document describes the proper selection of the filler metals, preheat/interpass temperatures, as well as, performance and procedure qualification requirements.
- 1.5. This specification is applicable for orders in either SI units (M 31M) or in inch-pound units (M 31). SI units and inch-pound units are not necessarily equivalent. Inch-pound units are shown in brackets in the text for clarity, but they are the applicable values when the material is ordered to M 31.

**Table 1**—Deformed Bar Designation Numbers, Nominal Masses, Nominal Dimensions, and Deformation Requirements, SI Units

Bar Designation No. <sup>b</sup>	Nominal Mass, kg/m	Nominal Dimensions <sup>a</sup>			Deformation Requirements, mm		
		Diameter, mm	Cross-Sectional Area, mm <sup>2</sup>	Perimeter, mm	Maximum Average Spacing	Minimum Average Height	Maximum Gap (Chord of 12.5% of Nominal Perimeter)
10	0.560	9.5	71	29.9	6.7	0.38	3.6
13	0.994	12.7	129	39.9	8.9	0.51	4.9
16	1.552	15.9	199	49.9	11.1	0.71	6.1
19	2.235	19.1	284	59.8	13.3	0.97	7.3
22	3.042	22.2	387	69.8	15.5	1.12	8.5
25	3.973	25.4	510	79.8	17.8	1.27	9.7
29	5.060	28.7	645	90.0	20.1	1.42	10.9
32	6.404	32.3	819	101.3	22.6	1.63	12.4
36	7.907	35.8	1006	112.5	25.1	1.80	13.7
43	11.38	43.0	1452	135.1	30.1	2.16	16.5
57	20.24	57.3	2581	180.1	40.1	2.59	21.9

<sup>a</sup> The nominal dimensions of a deformed bar are equivalent to those of a plain round bar having the same mass per meter as the deformed bar.

<sup>b</sup> Bar designation numbers approximate the number of millimeters of the nominal diameter of the bar.

**Table 2**—Deformed Bar Designation Numbers, Nominal Weights, Nominal Dimensions, and Deformation Requirements

Bar Designation No. <sup>b</sup>	Nominal Weight, lb/ft	Nominal Dimensions <sup>a</sup>			Deformation Requirements, in.		
		Diameter, in.	Cross-Sectional Area, in. <sup>2</sup>	Perimeter, in.	Maximum Average Spacing	Minimum Average Height	Maximum Gap (Chord of 12.5% of Nominal Perimeter)
3	0.376	0.375	0.11	1.178	0.262	0.015	0.143
4	0.668	0.500	0.20	1.571	0.350	0.020	0.191
5	1.043	0.625	0.31	1.963	0.437	0.028	0.239
6	1.502	0.750	0.44	2.356	0.525	0.038	0.286
7	2.044	0.875	0.60	2.749	0.612	0.044	0.334
8	2.670	1.000	0.79	3.142	0.700	0.050	0.383
9	3.400	1.128	1.00	3.544	0.790	0.056	0.431
10	4.303	1.270	1.27	3.990	0.889	0.064	0.487
11	5.313	1.410	1.56	4.430	0.987	0.071	0.540
14	7.65	1.693	2.25	5.32	1.185	0.085	0.648
18	13.60	2.257	4.00	7.09	1.58	0.102	0.864

<sup>a</sup> The nominal dimensions of a deformed bar are equivalent to those of a plain round bar having the same weight per foot as the deformed bar.

<sup>b</sup> Bar numbers are based on the number of eighth of an inch included in the nominal diameter of the bars.

## 2. REFERENCED DOCUMENTS

### 2.1.

#### AASHTO Standards:

- M 160, General Requirements for Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use
- T 244, Mechanical Testing of Steel Products
- T 285, Bend Test for Bars for Concrete Reinforcement

- 2.2. *ASTM Standards:*
- A 510, Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel
  - A 510M, Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel
  - A 700, Recommended Practices for Packaging, Marking, and Loading Methods for Steel Products for Domestic Shipment
  - A 706/A 706M, Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
  - E 29, Using Significant Digits in Test Data to Determine Conformance with Specifications
- 2.3. *Military Standards:*
- MIL-STD-129, Marking for Shipment and Storage
  - MIL-STD-163, Steel Mill Products Preparation for Shipment and Storage
- 2.4. *Federal Standard:*
- Fed. Std. No. 123, Marking for Shipment (Civil Agencies)
- 2.5. *AWS Standard:*
- ANSI/AWS D1.4, Structural Welding Code—Reinforcing Steel

### 3. TERMINOLOGY

#### 3.1. *Description of Terms Specific to This Standard:*

- 3.1.1. *deformed bar*—steel bar with protrusions; a bar that is intended for use as reinforcement in reinforced concrete construction.
- 3.1.1.1. *Discussion*—The surface of the bar is provided with lugs or protrusions that inhibit longitudinal movement of the bar relative to the concrete surrounding the bar in such construction. The lugs or protrusions conform to the provisions of this specification.
- 3.1.2. *deformations*—transverse protrusions on a deformed bar.
- 3.1.3. *plain bar*—steel bar without protrusions.
- 3.1.4. *rib*—longitudinal protrusion on a deformed bar.

### 4. ORDERING INFORMATION

- 4.1. It shall be the responsibility of the purchaser to specify all requirements that are necessary for material ordered to this specification. Orders for material under this specification should include the following information:
- 4.1.1. Quantity (Mass) [weight],
- 4.1.2. Name of the material (deformed and plain carbon steel bars for concrete reinforcement),

- 4.1.3. Size,
- 4.1.4. Cut length or coils,
- 4.1.5. Deformed or plain,
- 4.1.6. Grade,
- 4.1.7. Packaging (see Section 21),
- 4.1.8. AASHTO designation and year of issue, and
- 4.1.9. Certified mill test reports (if desired). (see Section 19)

### 5. MATERIAL AND MANUFACTURE

- 5.1. The bars shall be rolled from properly identified heats of mold cast or strand cast steel using the electric furnace, basic-oxygen, or open-hearth process.

### 6. CHEMICAL REQUIREMENTS

- 6.1. An analysis of each heat of steel shall be made by the manufacturer from test samples taken preferably during the pouring of the heats. The percentages of carbon, manganese, phosphorus, and sulfur shall be determined. The phosphorus content thus determined shall not exceed 0.06 percent.
- 6.2. An analysis may be made by the purchaser from finished bars. The phosphorus content thus determined shall not exceed that specified in Section 6.1 by more than 25 percent.

### 7. REQUIREMENTS FOR DEFORMATIONS

- 7.1. Deformations shall be spaced along the bar at substantially uniform distances. The deformations on opposite sides of the bar shall be similar in size, shape, and pattern.
- 7.2. The deformations shall be placed with respect to the axis of the bar so that the included angle is not less than 45°. Where the line of deformations forms an included angle with the axis of the bar from 45° to 70° inclusive, the deformations shall alternately reverse in direction on each side, or those on one side shall be reversed in direction from those on the opposite side. Where the line of deformation is over 70°, a reversal in direction is not required.
- 7.3. The average spacing or distance between deformations on each side of the bar shall not exceed seven-tenths of the nominal diameter of the bar.
- 7.4. The overall length of deformations shall be such that the gap (measured as a cord) between the ends of the deformations shall not exceed 12.5 percent of the nominal perimeter of the bar. Where the ends terminate in a rib, the width of the rib shall be considered as the gap between these ends. The summation of the gaps shall not exceed 25 percent of the nominal perimeter of the bar. The nominal perimeter of the bar shall be 3.1416 times the nominal diameter.

- 7.5. The spacing, height, and gap of deformations shall conform to the requirements prescribed in Table 1 [Table 2].

## 8. MEASUREMENTS OF DEFORMATIONS

- 8.1. The average spacing of deformations shall be determined by measuring the length of a minimum of 10 spaces and dividing that length by the number of spaces included in the measurement. The measurement shall begin from a point on a deformation at the beginning of the first space to a corresponding point on a deformation after the last included space. Spacing measurements shall not be made over a bar area containing bar marking symbols involving letters or numbers.
- 8.2. The average height of deformations shall be determined from measurements made on not less than two typical deformations. Determinations shall be based on three measurements per deformation, one at the center of the overall length and the other two at the quarter points of the overall length.
- 8.3. Insufficient height, insufficient circumferential coverage, or excessive spacing of deformations shall not constitute cause for rejection unless it has been clearly established by determinations on each lot (Note 2) tested that typical deformation height, gap, or spacing do not conform to the minimum requirements prescribed in Section 7. No rejection may be made on the basis of measurements if fewer than 10 adjacent deformations on each side of the bar are measured.
- Note 2**—A lot is defined as all the bars of one bar number and pattern of deformation contained in an individual shipping release or shipping order.

## 9. TENSILE REQUIREMENTS

- 9.1. The material, as represented by the test specimens, shall conform to the requirements for tensile properties prescribed in Table 3 [Table 4].

**Table 3**—Tensile Requirements, SI Units

	Grade 280 <sup>a</sup>	Grade 420	Grade 520 <sup>b</sup>
Tensile strength, min MPa	420	620	690
Yield strength, min Mpa	280	420	520
Elongation in 203.2 mm, min %			
Bar Designation No.			
10	11	9	—
13, 16	12	9	—
19	12	9	7
22, 25	—	8	7
29, 32, 36	—	7	6
43, 57	—	7	6

<sup>a</sup> Grade 280 bars are furnished only in sizes 10 through 19.

<sup>b</sup> Grade 520 bar are furnished only in sizes 19 through 57.

**Table 4**—Tensile Requirements

	Grade 40 <sup>a</sup>	Grade 60	Grade 75 <sup>b</sup>
Tensile strength, min psi	60000	90000	100000
Yield strength, min psi	40000	60000	75000
Elongation in 8 in., min %			
Bar Designation No.			
3	11	9	—
4, 5	12	9	—
6	12	9	7
7, 8	—	8	7
9, 10, 11	—	7	6
14, 18	—	7	6

<sup>a</sup> Grade 40 bars are furnished only in sizes 3 through 6.

<sup>b</sup> Grade 75 are furnished only in sizes 11, 14, and 18.

- 9.2. The yield point or yield strength shall be determined by one of the following methods:

- 9.2.1. The yield point shall be determined by drop of the beam or halt of the point method as described in Section 13.1.1 of T 244.

- 9.2.2. Where the steel tested does not exhibit a well-defined yield point, the yield point shall be determined at extension under load using an autographic diagram method or an extensometer as described in Sections 13.1.2 and 13.1.3 of T 244.

The extension under load shall be 0.005 mm/mm [0.005 in./in.] of gauge length (0.5 percent) for Grade 280 [40] and Grade 420 [60] and shall be 0.0035 mm/mm [0.0035 in./in.] of gauge length (0.35 percent) for Grade 520 [75]. When material is furnished in coils, the test sample must be straightened prior to placing it in the jaws of the tensile machine. Straightening shall be done carefully to avoid the formation of local sharp bends and to minimize cold work. Insufficient straightening before attaching the extensometer can result in lower-than-actual yield strength readings.

- 9.3. The percentage of elongation shall be as prescribed in Table 3 [Table 4] when tested in accordance with Section 13.4 of T 244.

## 10. BENDING REQUIREMENTS

- 10.1. The bend-test specimen shall withstand being bent around a pin without cracking on the outside radius of the bent portion when tested in accordance with T 285. The requirements for angle of bending and sizes of pins are prescribed in Table 5 [Table 6]. When material is furnished in coils, the test sample must be straightened prior to placing it in the bend tester.

- 10.2. The bend test shall be made on specimens of sufficient length to ensure free bending and with apparatus which provides:

- 10.2.1. Continuous and uniform application of force throughout the duration of the bending operation.

- 10.2.2. Unrestricted movement of the specimen at points of contact with the apparatus and bending around a pin free to rotate.

- 10.2.3. Close wrapping of the specimen around the pin during the bending operation.

- 10.3. It is permissible to use more severe methods of bend testing, such as placing a specimen across two pins free to rotate and applying the bending force with a fixed pin. When failures occur under more severe methods, retests shall be permitted under the bend test method prescribed in Section 10.2

**Table 5—Bend Test Requirements, SI Units**

Bar Designation No.	Pin Diameter for Bend Test <sup>a</sup>		
	Grade 280	Grade 420	Grade 520
10, 13, 16	$3\frac{1}{2}d^b$	$3\frac{1}{2}d$	—
19	$5d$	$5d$	$5d$
22, 25	—	$5d$	$5d$
29, 32, 36	—	$7d$	$7d$
43, 57, (90°)	—	$9d$	$9d$

<sup>a</sup> Test bends 180 degrees unless noted otherwise.

<sup>b</sup>  $d$  = nominal diameter of specimen.

**Table 6—Bend Test Requirements**

Bar Designation No.	Pin Diameter for Bend Test <sup>a</sup>		
	Grade 40	Grade 60	Grade 75
3, 4, 5	$3\frac{1}{2}d^b$	$3\frac{1}{2}d$	—
6	$5d^b$	$5d$	—
7, 8	—	$5d$	—
9, 10	—	$7d$	—
11	—	$7d$	$7d$
14, 18, (90°)	—	$9d$	$9d$

<sup>a</sup> Test bends 180 degrees unless noted otherwise.

<sup>b</sup>  $d$  = nominal diameter of specimen.

## 11. PERMISSIBLE VARIATION IN MASS [WEIGHT]

- 11.1. The permissible variation shall not exceed six percent under nominal mass [weight], except for bars smaller than 9.5 mm [ $\frac{3}{8}$  in.] plain round, the permissible variation in mass [weight] shall be computed upon the basis of the permissible variation in diameter in ASTM A 510M [ASTM A 510]. For larger bars up to and including 63.5 mm [ $2\frac{1}{2}$  in.], use AASHTO M 160. Reinforcing bars are evaluated on the basis of nominal mass [weights]. In no case shall the overmass [overweight] of any bar be the cause for rejection.
- 11.2. The specified limit of variation shall be evaluated in accordance with ASTM E 29 (rounding method).

## 12. FINISH

- 12.1. The bar shall be free of detrimental surface imperfections.
- 12.2. Rust, seams, surface irregularities, or mill scale shall not be cause for rejection, provided the weight, dimensions, cross-sectional area, and tensile properties of a hand wire-brushed test specimen are not less than the requirements of this specification.
- 12.3. Surface imperfections other than those specified in Section 12.2 shall be considered detrimental when specimens containing such imperfections fail to conform to either tensile or bending

requirements. Examples include, but are not limited to, laps, seams, scabs, slivers, cooling or casting cracks, and mill or guide marks (Notes 3 and 4).

**Note 3**—Reinforcing bar intended for epoxy coating application should have surfaces with a minimum of sharp edges to achieve proper cover. Particular attention should be given to bar marks and deformations where coating difficulties are prone to occur.

**Note 4**—Deformed bars destined to be mechanically spliced or butt-welded may require a certain degree of roundness in order for the splices to adequately achieve strength requirements.

## 13. TEST SPECIMENS

- 13.1. All mechanical tests shall be conducted in accordance with Test Methods and Definitions T 244 including Annex A9.
- 13.2. Tension test specimens shall be the full section of the bar as rolled. The unit stress determinations on full-sized specimens shall be based on the nominal bar area.
- 13.3. The bend-test specimens shall be the full section of the bar as rolled.

## 14. NUMBER OF TESTS

- 14.1. For bar sizes No. 10 to 36 [3 to 11], inclusive, one tension test and one bend test shall be made of the largest size rolled from each heat. If, however, material from one heat differs by three or more designation numbers, one tension and one bend test shall be made from both the highest and lowest designation numbers of the deformed bars rolled.
- 14.2. For bar sizes Nos. 43 and 57 [14 and 18] bars, one tension test and one bend test shall be made of each size from each heat.
- 14.3. For all bar sizes one set of dimensional property tests including bar mass [weight] and spacing, height, and gap of deformations shall be made of each bar size rolled from each heat.

## 15. RETESTS

- 15.1. If results of an original tension specimen fail to meet the specified minimum requirements and are within 14 MPa [2000 psi] of the required tensile strength, within 7 MPa [1000 psi] of the required yield strength, or within two percentage units of the required elongation, a retest shall be permitted on two random specimens for each original tension specimen failure from the lot. Both retest specimens shall meet the requirements of this specification.
- 15.2. If a bend test fails for reasons other than mechanical reasons or flaws in the specimen as described in Sections 15.4.2 and 15.4.3, a retest shall be permitted on two random specimens from the same lot. If the results of both test specimens meet the specified requirements, the lot shall be accepted. The retest shall be performed on test specimens that are at air temperature, but not less than 16°C [60°F].
- 15.3. If a mass [weight] test fails for reasons other than flaws in the specimen as described in Section 15.4.3, a retest shall be permitted on two random specimens from the same lot. Both retest specimens shall meet the requirements of this specification.

- 15.4. If the original test or any of the random retests fails because of reasons listed in Sections 15.4.1, 15.4.2, or 15.4.3, the test shall be considered an invalid test:
- 15.4.1. The elongation property of any tension test specimen is less than that specified and any part of the fracture is outside the middle half of the gauge length, indicated by scribe marks on the specimen before testing.
- Note 5**—Marking specimens with multiple scribes or punch marks can reduce the occurrence of fracture outside or near these marks and the need for declaring the test invalid.
- 15.4.2. Mechanical reasons such as failure of testing equipment or improper specimen preparation,
- 15.4.3. Flaws are detected in a test specimen, either before or during the performance of the test.
- 15.5. The original results from Sections 15.4.1, 15.4.2, or 15.4.3 shall be discarded and the test shall be repeated on a new specimen from the same lot.

## 16. INSPECTION

- 16.1. The inspector representing the purchaser shall have free entry, at all times while work on the contract of the purchaser is being performed, to all parts of the manufacturer's works that concern the manufacture of the material ordered. The manufacturer shall afford the inspector all reasonable facilities to satisfy him that the material is being furnished in accordance with this specification. All tests (except product analysis) and inspection shall be made at the place of manufacture prior to shipment, unless otherwise specified, and shall be so conducted as not to interfere unnecessarily with the operation of the works.
- 16.2. *For Government Procurement Only*—Except as otherwise specified in the contract, the contractor is responsible for the performance of all inspection and test requirements specified herein and may use his own or any other suitable facilities for the performance of the inspection and test requirements specified herein, unless disapproved by the purchaser at the time of purchase. The purchaser shall have the right to perform any of the inspections and tests at the same frequency as set forth in this specification, where such inspections are deemed necessary to assure that material conforms to prescribed requirements.

## 17. REJECTION

- 17.1. Unless otherwise specified, any rejection based on tests made in accordance with Section 6.2 shall be reported to the manufacturer within five working days from the receipt of samples by the purchaser.
- 17.2. Material that shows injurious defects subsequent to its acceptance at the manufacturer's works will be rejected, and the manufacturer shall be notified.

## 18. REHEARING

- 18.1. Samples tested in accordance with Section 6.2 that represent rejected material shall be preserved for two weeks from the date rejection is reported to the manufacturer. In case of dissatisfaction with the results of the tests, the manufacturer may make claim for a rehearing within that time.

## 19. TEST REPORTS

- 19.1. When specified in the purchase order, report the following information, on a per heat basis. Additional items may be reported as requested or desired.
- 19.1.1. Chemical analysis including carbon, manganese, phosphorus, and sulfur.
- 19.1.2. Tensile properties.
- 19.1.3. Bend test.
- 19.2. Material Test Report, Certificate of Inspection, or similar document printed from or used in electronic form from an electronic data interchange (EDI) transmission shall be regarded as having the same validity as a counterpart printed in the certifier's facility. The content of the EDI transmitted document must meet the requirements of the invoked AASHTO standard(s) and conform to any EDI agreement between the purchaser and the supplier. Notwithstanding the absence of a signature, the organization submitting the EDI transmission is responsible for the content of the report.

## 20. MARKING

- 20.1. When loaded for mill shipment, bars shall be properly separated and tagged with the manufacturer's heat or test identification number.
- 20.2. Each producer shall identify the symbols of his marking system.
- 20.3. All bars produced to this specification, except plain round bars which shall be tagged for grade, shall be identified by a distinguishing set of marks legibly rolled into the surface of one side of the bar to denote in the following order:
- 20.3.1. *Point of Origin*—Letter or symbol established as the producer's mill designation.
- 20.3.2. *Size Designation*—Arabic number corresponding to bar designation number of Table 1 [Table 2].
- 20.3.3. *Type of Steel*—Letter *S* indicates that the bar was produced to this specification or for Grade 420 [60] bars only; letters *S* and *W* indicate that the bar was produced to meet both Specifications M 31M/M 31 and ASTM A 706/A 706M.

20.3.4. *Minimum Yield Designation*—For Grade 420 [60] bars, either the number 4 [60] or a single continuous longitudinal line through at least five spaces offset from the center of the bar side. For Grade 520 [75] bars, either the number 5 [75] or two continuous longitudinal lines through at least five spaces offset each direction from the center of the bar. (No marking designation for Grade 280 [40] bars.)

20.3.5. It shall be permissible to substitute: a metric size bar of Grade 280 for the corresponding inch-pound size bar of Grade 40, a metric size bar of Grade 420 for the corresponding inch-pound size bar of Grade 60, and a metric size bar of Grade 520 for the corresponding inch-pound size bar of Grade 75.

## 21. PACKAGING

21.1. When specified in the purchase order, packaging shall be in accordance with the procedures in ASTM A 700.

21.2. *For Government Procurement Only*—When specified in the contract or order, and for direct procurement by or direct shipment to the U.S. Government, material shall be preserved, packaged, and packed in accordance with the requirements of MIL-STD-163. The applicable levels shall be as specified in the contract. Marking for shipment of such material shall be in accordance with Fed. Std. No. 123 for civil agencies and MIL-STD-129 for military agencies.

## 22. KEYWORDS

22.1. Concrete reinforcement; deformations (protrusions); steel bars.

<sup>1</sup> Agrees with ASTM A 615/A 615M-06a except for the bend testing procedure, which is referenced to T 285 and Section 9.2.2.

## Standard Specification for

# Steel Wire, Plain, for Concrete Reinforcement

AASHTO Designation: M 32M/M 32-09

ASTM Designation: A 82/A 82M-07



## 1. SCOPE

- 1.1. This specification covers cold-drawn, steel wire, as drawn or galvanized, to be used as such or in fabricated form, for the reinforcement of concrete, in sizes not less than 2.03 mm [0.080 in.] nominal diameter.
- 1.2. Supplement S1 describes high-strength wire, which shall be furnished when specifically ordered. It shall be permissible to furnish high-strength wire in place of regular wire if mutually agreed to by the purchaser and the manufacturer.
- 1.3. The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in nonconformance with the standard. (The inch-pound units are shown in brackets except in Table 6.)

## 2. REFERENCED DOCUMENTS

- 2.1. *AASHTO Standards:*
  - M 55M/M 55, Steel Welded Wire Reinforcement, Plain, for Concrete
  - T 244, Mechanical Testing of Steel Products
- 2.2. *ASTM Standards:*
  - A 641/A 641M, Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
  - A 700, Practices for Packaging, Marking, and Loading Methods for Steel Products for Domestic Shipment
  - E 83, Practice for Verification and Classification of Extensometer Systems
- 2.3. *Military Standard:*
  - MIL-STD-129, Marking for Shipment and Storage
- 2.4. *Federal Standard:*
  - Fed. Std. No. 123, Marking for Shipments (Civil Agencies)
- 2.5. *Other Standard:*
  - ACI 318; Building Code Requirements for Structural Concrete