

1 **SECTION 709 - REINFORCING STEEL, WIRE ROPE, AND**
2 **PRESTRESSING STEEL**

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4
5 **709.01 Reinforcing Steel.**

6
7 **(A) Bar Reinforcement.** Bar reinforcement shall conform to
8 AASHTO M 31 for billet-steel bars or ASTM A 706 for low-alloy steel bars,
9 and the following requirements:

10
11 **(1)** Bars shall be deformed type.

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13 **(2)** Bars shall be Grade 40 or, for ASTM A 706 bars or when
14 specified for AASHTO M 31 bars, Grade 60.

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16 **(3)** Cold twisted bars will not be allowed.

17
18 **(B) Steel Wire Reinforcement.** Steel wire reinforcement shall conform to
19 AASHTO M 32.

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21 **(C) Welded Wire Fabric Reinforcement.** Welded wire fabric
22 reinforcement shall conform to:

23
24 **(1)** AASHTO M 55 if smooth wire.

25
26 **(2)** AASHTO M 221 if deformed wire.

27
28 Only flat sheets of welded wire fabric reinforcement shall be used. No
29 rolled welded wire fabric reinforcement will be allowed.

30
31 **(D) Bar Mat Reinforcement.** Bar mat reinforcement shall conform to
32 AASHTO M 54. Bars shall conform to Subsection 709.01(A) - Bar
33 Reinforcement.

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35 **(E) Dowels.**

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37 **(1) General.** Plain and deformed bar dowels shall conform to
38 AASHTO M 31, Grade 40 or Grade 60.

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40 **(2) Joint Dowels.** Plain dowels used at expansion joints and other
41 specified locations, and dowels used as load transfer devices in
42 portland cement concrete pavement, shall be painted with one coat of
43 tar paint for half of dowel length before delivery to work site.

44
45 Dowel expansion caps shall conform to the following and shall
46 be submitted and accepted prior to installation:

47 **(a)** Made of metal or PVC pipe, non-collapsible under
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- 49 construction or service loads, and having one closed end.
50
51 (b) Sized with inside diameter 1/16 inch greater than dowel
52 diameter; and length to cover at least 2 inches of dowel, plus or
53 minus one inch, when dowel is inserted.
54
55 (c) Designed to allow free movement of dowels.
56
57 (d) Equipped with device to stop dowel at least one inch
58 from end of cap.
59
60 (e) Made with end of cap filled with soft, compressible
61 material, or void to permit free dowel movement for distance
62 equivalent to 150 percent of joint width.
63
64 (F) **Tie Bars.** Tie bars for pavement joints shall be one of the following:
65
66 (1) Deformed billet-steel reinforcing bars of Grade 40 or Grade 60
67 conforming to AASTHO M 31.
68
69 (2) Deformed rail-steel reinforcing bars of Grade 50 or Grade 60
70 conforming to AASTHO M 42.
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709.02 **Wire Rope or Wire Cable.** Guardrail and restrainer cables shall be as follows:

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74
75 (A) 3/4-inch preformed, 6 by 19 wire strand core or independent wire rope
76 core (IWRC).
77
78 (B) Zinc coated in accordance with ASTM A 603.
79
80 (C) Class A coating.
81
82 (D) Right regular lay.
83
84 (E) Improved plow steel.
85
86 (F) Material with minimum breaking strength of 23 tons.
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88 Original and one copy of certificate of compliance and mill test report shall be
89 submitted for each manufactured length of cable used.
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91 Two test samples of wire rope or wire cable shall be submitted for every
92 group of 50 cable assemblies or fraction of a group. Samples shall be 4-1/2 feet
93 long with grooved, closed spelter sockets at the ends. Spelter sockets shall conform
94 to Federal Specification RR-S-550D(1), Type B.
95

96 Cable assemblies shall consist of cables, swaged fittings, studs, nuts; and

97 when indicated in the contract documents, turnbuckles, clevises, and cable clips.
98 Cable assemblies shall conform to the following requirements:

99
100 Swaged fittings shall be machined from hot-rolled steel bars
101 conforming to AISI 1035 and shall be annealed, suitable for cold swaging.
102 Swaged fittings shall be zinc coated before swaging. A lock pin hole to
103 accommodate 1/4-inch plated spring steel pin shall be drilled through head of
104 swaged fitting to retain stud in proper position. Manufacturer's identifying
105 mark shall be stamped on body of swaged fitting.

106
107 One-inch diameter stud shall conform to ASTM A 449 after zinc
108 coating. Prior to zinc coating, 3/8-inch slot for locking pin shall be milled in
109 stud end.

110
111 Nuts shall conform to AASHTO M 291, including Appendix X1, except
112 lubrication is not required.

113
114 Turnbuckle bodies shall be steel pipe type conforming to ASTM
115 F 1145, Type II. Turnbuckle pulls shall consist of a swaged fitting and stud
116 assembly, shall conform to AISI 1035, and shall be annealed, suitable for
117 cold swaging.

118
119 Clevises shall be drop forged, zinc-coated steel.

120
121 Cable clips shall be commercial quality, drop forged, zinc-coated steel
122 conforming to Federal Specification FF-C-450D(1), Type 1, Class 1.

123
124 Swaged fittings, turnbuckles, clevises, stud and nut assembly shall
125 develop specified cable breaking strength.

126
127 Cable assemblies shall be shipped as complete unit, including stud,
128 nut, and when required, turnbuckle, clevis, and cable clips.

129
130 The Contractor shall be responsible for determining required restrainer
131 cable assembly lengths.

132
133 Free ends of cable shall be securely wrapped to prevent separation.

134
135 Steel parts and cable assemblies shall be zinc coated in accordance with
136 Subsection 712.10 - Zinc Coating.

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138 **709.03 Prestressing Steel.** Prestressing steel shall be strand or bars.

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140 **A) Strand.** Strand shall be uncoated, 7-wire, low-relaxation steel
141 conforming to AASHTO M 203 Grade 270.

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(B) Bars. Bars shall be high-tensile strength alloy conforming to AASHTO M 275.

(C) Testing Requirements. Wire, strand, bars, and anchorage assemblies shall be assigned and tagged with lot numbers for identification purpose.

Test samples shall be representative of the lot. Samples of wire or strand shall be taken from same master roll.

Materials, including tendons, shall be furnished for testing at no increase in contract price or contract time and delivered ahead of anticipated use. Samples submitted for testing shall conform to following:

(1) Pretensioned Construction. Three samples in 3-foot lengths shall be provided for each strand size, including one sample from each manufactured reel of prestressing steel strand.

(2) Post-Tensioned Construction.

(a) For wires that require heading, samples shall be 5 feet long.

(b) For wires that do not require heading, samples shall be of sufficient length to make one parallel-laid cable, 5 feet long, comprised of same number of wires as cable to be furnished.

(c) For strand to be furnished with fittings, samples shall be 5 feet long between near ends of fittings.

(d) For bars to be furnished with threaded ends and nuts, samples shall be 5 feet long between threads at ends.

(e) Two anchorage assemblies, complete with distribution plates of each size and type specified, shall be provided if anchorage assemblies have not been included with reinforcement samples.

END OF SECTION 709