

5.14 PRESTRESSING STEEL PROPERTIES

5.14.1 GENERAL

This BDM provides commonly used material properties for prestressing strands and bars per AASHTO LRFD Bridge Design Specifications, Articles 5.4.4.1 and 5.4.4.2. Prestressing strand applications are often used in superstructure design, where prestressing tendons can reach lengths exceeding 1,000 feet. For shorter applications, usually less than 60 feet, high-strength bar systems are more practical and exhibit less prestress loss during stressing.

5.14.2 PRESTRESSING STRANDS

The material properties for prestressing strand conform to ASTM A416/A416M Grade 270 ($f_{pu} = 270$ ksi) - low relaxation. This strand is made up of seven wires and can be fabricated with an epoxy coating complying with ASTM A882/A882M to provide corrosion protection. The modulus of elasticity for design should be taken as 28.5×10^3 ksi. Table 5.14.2-1 includes prestressing strand material properties for strand diameters ranging from 3/8 to 0.7 inches. 0.6-inch diameter strands are utilized in most prestressed girder applications. Smaller diameter strands are generally used in smaller bridge components such as precast deck panels. The values in Table 5.14.2-1 are calculated using the CA Amendment Table 5.9.2.2-1.

Table 5.14.2-1 Prestressing Strand Material Properties

Strand Diameter (inches)	3/8	1/2	0.6	0.7
Nominal Area (in ²)	0.085	0.153	0.217	0.294
Nominal Weight (plf)	0.29	0.52	0.74	1.00
Minimum Breaking Strength (kips) ($f_{pu} = 270$ ksi)	22.95	41.31	58.59	79.38
Maximum Jacking/Transfer Strength (kips) ($f_{pbt} = 0.75f_{pu}$)	17.21	30.98	43.94	59.54
Minimum Yield Strength at 1% Extension (kips) ($f_{py} = 0.9f_{pu}$)	20.66	37.18	52.73	71.44

5.14.3 PRESTRESSING BARS

The material properties for prestressing bars conform to ASTM A722/A722M Type II deformed bars ($f_{pu} = 150$ ksi). The modulus of elasticity for design should be taken as 30.0×10^3 ksi. Table 5.14.3-1 presents material properties for high-strength steel bars with diameters ranging from 3/4 to 1-3/4 inches. Typical applications for prestressing bars may be used in short-span bridges, transverse prestressing of adjacent precast sections, bent caps, hinges, and bridge strengthening elements. The values on the table 5.14.3-1 are calculated using the CA Amendment Table 5.9.2.2-1

Table 5.14.3-1 Prestressing Bar Material Properties

Bar Diameter (inches)	3/4	1	1 1/4	1 3/8	1 3/4
Nominal Area (in ²)	0.42	0.85	1.25	1.58	2.58
Nominal Weight (plf)	1.49	3.01	4.39	5.56	9.10
Minimum Breaking Strength (kips) ($f_{pu} = 150$ ksi)	63.00	127.50	187.50	237.00	387.00
Maximum Jacking Strength (kips) ($f_{pbt} = 0.75f_{pu}$)	47.25	95.63	140.63	177.8	290.25
Minimum Yield Strength (kips) ($f_{py} = 0.8f_{pu}$)	50.40	102.00	150.00	189.60	309.60

5.14.4 REFERENCES

1. ASTM. (2018). A722/A722M – *Standard Specification for High-Strength Steel Bars for Prestressed Concrete*.
2. ASTM. (2020). A822/A822M – *Standard Specification for Filled Epoxy-Coated Seven-Wire Steel Prestressing Strand*.
3. ASTM. (2024). A416/A416M – *Standard Specification for Low-Relaxation, Seven-Wire Steel Strand for Prestressed Concrete*.
4. Caltrans. (2025). *California Amendments to AASHTO LFRD Bridge Design Specifications, 8th Edition*, California Department of Transportation, Sacramento, CA.
5. Caltrans. (2025). *Standard Specifications*, California Department of Transportation, Sacramento, CA.