

CODE

(ii) Uniform elongation requirements for all grades of **ASTM A706** reinforcement shall be as specified in Table 20.2.1.3(c), and uniform elongation shall be determined as the elongation at the maximum force sustained by the reinforcing bar test piece.

(iii) For all grades of ASTM A706 reinforcement, the radius at the base of each deformation shall be at least 1.5 times the height of the deformation. This requirement applies to all deformations, including transverse lugs, longitudinal ribs, grade ribs, grade marks, and intersections between deformations. Conformance shall be assessed by measurements taken on newly-machined rolls used to manufacture reinforcing bars, instead of measurements taken on bar samples.

COMMENTARY

production of reinforcement. The method for determination of uniform elongation specified in 20.2.1.3(b)(ii) is taken from **ASTM E8**.

Low-alloy steel deformed bars conforming to **ASTM A706** are intended for applications where controlled tensile properties are required. ASTM A706 also includes restrictions on chemical composition to enhance weldability for Grades 420 and 550.

Rail-steel deformed bars used with this Code are required to conform to **ASTM A996**, including the provisions for Type R bars. Type R bars are required to meet more restrictive provisions for bend tests than other types of rail steel.

Stainless steel deformed bars are used in applications where high corrosion resistance or controlled magnetic permeability are required.

Low-carbon chromium steel is a high-strength material that is permitted for use as transverse reinforcement for confinement in special earthquake-resistant structural systems and spirals in columns. Refer to Tables 20.2.2.4(a) and (b). **ASTM A1035** provides requirements for bars of two minimum yield strength levels—690 MPa and 830 MPa—designated as Grade 690 and Grade 830, respectively, but the maximum f_y permitted for design calculations in this Code is limited in accordance with 20.2.2.3.

In 2015, **ASTM A615** included bar sizes larger than No. 57, and in 2016, ASTM A1035 also included bar sizes larger than No. 57. Bar sizes larger than No. 57 are not permitted by this Code due to the lack of information on their performance including bar bends and development lengths.

Table 20.2.1.3(a)—Modified tensile strength and additional tensile property requirements for ASTM A615 reinforcement

	Grade 280	Grade 420	Grade 550	Grade 690
Tensile strength, minimum, MPa	420	550	690	790
Ratio of actual tensile strength to actual yield strength, minimum	1.10	1.10	1.10	1.10

Table 20.2.1.3(b)—Tensile property requirements for ASTM A706 Grade 690 reinforcement

	Grade 690
Tensile strength, minimum, MPa	807
Ratio of actual tensile strength to actual yield strength, minimum	1.17
Yield strength, minimum, MPa	690
Yield strength, maximum, MPa	814
Fracture elongation in 200 mm, minimum, %	10

Table 20.2.1.3(c)—Uniform elongation requirements for ASTM A706 reinforcement

	Grade 420	Grade 550	Grade 690
Uniform elongation, minimum, percent			
Bar designation No.			
10, 13, 16, 19, 22, 25, 29, 32	9	7	6
36, 43, 57	6	6	6

(c) **ASTM A996** – axle steel and rail steel; bars from rail steel shall be Type R

(d) **ASTM A955** – stainless steel

(e) **ASTM A1035** – low-carbon chromium steel

20.2.1.4 Plain bars for spiral reinforcement shall conform to **ASTM A615**, A706, A955, or A1035.

R20.2.1.4 Plain bars are permitted only for spiral reinforcement used as transverse reinforcement for columns,