(c) For sections with slender legs

$$M_n = F_{cr} S_c \tag{F10-8}$$

where

$$F_{cr} = \frac{0.71E}{\left(\frac{b}{t}\right)^2} \tag{F10-9}$$

b = outside width of leg in compression, in. (mm)

S_c = elastic section modulus to the toe in compression relative to the axis of bending, in.^{3} (mm^3). For bending about one of the *geometric axes* of an equal-leg angle with no lateral-torsional restraint, S_c shall be 0.80 of the geometric axis section modulus.

F11. RECTANGULAR BARS AND ROUNDS

This section applies to rectangular bars bent about either *geometric axis* and rounds.

The *nominal flexural strength*, M_n, shall be the lower value obtained according to the *limit states* of *yielding* (*plastic moment*) and *lateral-torsional buckling*, as required.

1. Yielding

For rectangular bars with $\frac{L_b d}{t^2} \leq \frac{0.08E}{F_y}$ bent about their major axis, rectangular bars bent about their minor axis, and rounds:

$$M_n = M_p = F_y Z \leq 1.6 M_y \tag{F11-1}$$

2. Lateral-Torsional Buckling

(a) For rectangular bars with $\frac{0.08E}{F_y} < \frac{L_b d}{t^2} \leq \frac{1.9E}{F_y}$ bent about their major axis:

$$M_n = C_b \left[1.52 - 0.274 \left(\frac{L_b d}{t^2}\right) \frac{F_y}{E}\right] M_y \leq M_p \tag{F11-2}$$

(b) For rectangular bars with $\frac{L_b d}{t^2} > \frac{1.9E}{F_y}$ bent about their major axis:

$$M_n = F_{cr} S_x \leq M_p \tag{F11-3}$$

where

$$F_{cr} = \frac{1.9EC_b}{\frac{L_b d}{t^2}} \tag{F11-4}$$

t = width of rectangular bar parallel to axis of bending, in. (mm)

d = depth of rectangular bar, in. (mm)

L_b = length between points that are either braced against lateral displacement of the compression region or braced against twist of the cross section, in. (mm)

(c) For rounds and rectangular bars bent about their minor axis, the *limit state* of *lateral-torsional buckling* need not be considered.

F12. UNSYMMETRICAL SHAPES

This section applies to all unsymmetrical shapes, except single angles.

The *nominal flexural strength*, M_n, shall be the lowest value obtained according to the *limit states* of *yielding (yield moment), lateral-torsional buckling* and *local buckling* where

$$M_n = F_n S \tag{F12-1}$$

where

S = lowest elastic section modulus relative to the axis of bending, in.^{3} (mm^3)

1. Yielding

$$F_n = F_y \tag{F12-2}$$

2. Lateral-Torsional Buckling

$$F_n = F_{cr} \leq F_y \tag{F12-3}$$

where

F_{cr} = buckling *stress* for the section as determined by analysis, ksi (MPa)

User Note: In the case of Z-shaped members, it is recommended that F_{cr} be taken as $0.5F_{cr}$ of a channel with the same flange and web properties.

3. Local Buckling

$$F_n = F_{cr} \leq F_y \tag{F12-4}$$

where

F_{cr} = buckling *stress* for the section as determined by analysis, ksi (MPa)

F13. PROPORTIONS OF BEAMS AND GIRDERS

1. Hole Reductions

This section applies to rolled or built-up shapes, and cover-plated *beams* with holes, proportioned on the basis of flexural strength of the gross section.

In addition to the *limit states* specified in other sections of this Chapter, the *nominal flexural strength*, M_n, shall be limited according to the limit state of *tensile rupture* of the tension flange.

(a) For $F_u A_{fn} \geq Y_t F_y A_{fg}$, the limit state of tensile rupture does not apply.