CODE

COMMENTARY

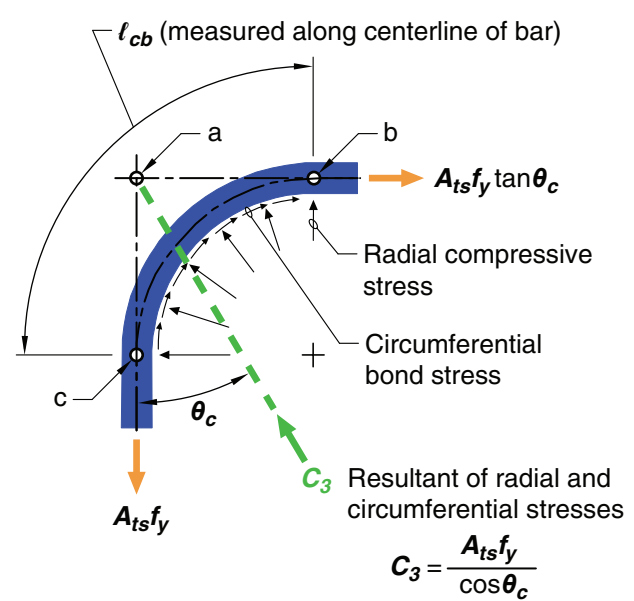$$C_3 = \frac{A_{ts}f_y}{\cos\theta_c}$$

Fig. R23.10.6—Forces acting on a curved-bar node where there is a difference in tie forces.

23.11—Earthquake-resistant design using the strut-and-tie method

23.11.1 Regions of a seismic-force-resisting system assigned to Seismic Design Category (SDC) D, E, or F and designed with the strut-and-tie method shall be in accordance with (a) and (b):

(a) Chapter 18
(b) 23.11.2 through 23.11.5 unless design earthquake-induced force, E, in the strut-and-tie element is multiplied by an overstrength factor, Ω_o, not less than 2.5 unless a smaller value of Ω_o can be justified by a detailed analysis.

R23.11—Earthquake-resistant design using the strut-and-tie method

R23.11.1 Strut-and-tie elements of a seismic-force-resisting system may experience strength degradation due to force and displacement reversals. Strut-and-tie elements do not require seismic detailing when the design force is amplified by Ω_o. It is preferable that the strength of the seismic-force-resisting system not be limited by the strength of the discontinuity region designed by the strut-and-tie method. For diaphragm design that includes amplified seismic forces, an additional amplification factor is not required.

Load combinations are provided in 5.3.1, and Eq. (5.3.1e) and (5.3.1g) are used for seismic design. The effects of E may cause reversal of forces in strut and tie elements. In such cases, different strut-and-tie models are developed for each loading direction.

23.11.2 *Strut strength*

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23.11.2.1 Effective compressive strength determined in accordance with 23.4 shall be multiplied by 0.8.

R23.11.2.1 A reduction factor is applied to account for cracking that is likely to develop in struts located in a region subjected to force reversals.

23.11.3 *Strut detailing*

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23.11.3.1 Struts shall have reinforcement satisfying the detailing requirements of 23.11.3.2 or 23.11.3.3.

R23.11.3.1 Two confinement options for struts are permitted. For 23.11.3.2, each strut contains longitudinal and transverse reinforcement as required for columns of special moment frames. For 23.11.3.3, the entire cross section of the region or member containing the struts are confined instead of the individual struts.