

CODE

where $k_c = 10$ for cast-in anchors and 7 for post-installed anchors.

17.6.2.2.2 k_c for post-installed anchors shall be permitted to be increased based on **ACI 355.2** or **ACI 355.4M** product-specific tests, but shall not exceed 24.

17.6.2.2.3 For single cast-in headed studs and headed bolts with $280 \text{ mm} \leq h_{ef} \leq 635 \text{ mm}$, N_b shall be calculated by:

$$N_b = 3.9\lambda_a \sqrt{f'_c} h_{ef}^{5/3} \quad (17.6.2.2.3)$$

17.6.2.3 Breakout eccentricity factor, $\psi_{ec,N}$

17.6.2.3.1 Modification factor for anchor groups loaded eccentrically in tension, $\psi_{ec,N}$, shall be calculated by Eq. (17.6.2.3.1).

$$\psi_{ec,N} = \frac{1}{\left(1 + \frac{2e'_N}{3h_{ef}}\right)} \leq 1.0 \quad (17.6.2.3.1)$$

COMMENTARY

The values of k_c in Eq. (17.6.2.2.1) were determined from a large database of test results in uncracked concrete at the 5 percent fractile (Fuchs et al. 1995). The values were adjusted to corresponding k_c values for cracked concrete (Eligehausen and Balogh 1995; Goto 1971). Tests have shown that the values of k_c applicable to adhesive anchors are approximately equal to those derived for expansion anchors (Eligehausen et al. 2006a; Zhang et al. 2001).

R17.6.2.2.3 For anchors with a deeper embedment ($h_{ef} > 280 \text{ mm}$), test evidence indicates the use of $h_{ef}^{1.5}$ can be overly conservative for some cases. An alternative expression (Eq. (17.6.2.2.3)) is provided using $h_{ef}^{5/3}$ for evaluation of cast-in headed studs and headed bolts with $280 \text{ mm} \leq h_{ef} \leq 635 \text{ mm}$. This expression can also be appropriate for some undercut post-installed anchors. However, for such anchors, the use of Eq. (17.6.2.2.3) should be justified by test results in accordance with 17.5.1.4. Experimental and numerical investigations indicate that Eq. (17.6.2.2.3) may be unconservative for $h_{ef} > 635 \text{ mm}$ if bearing pressure on the anchor head is at or near the limit permitted by Eq. (17.6.3.2.2a) (Ozbolt et al. 2007).

R17.6.2.3 Breakout eccentricity factor, $\psi_{ec,N}$

R17.6.2.3.1 Figure 17.6.2.3.1(a) shows an anchor group where all anchors are in tension but the resultant force is eccentric with respect to the centroid of the anchor group. Anchors can also be loaded in such a way that only some of the anchors are in tension (Fig. 17.6.2.3.1(b)). In this case, only the anchors in tension are to be considered for the calculation of e'_N . The eccentricity e'_N of the resultant tensile force is determined with respect to the center of gravity of the anchors in tension.