CODE

17.6.4 *Concrete side-face blowout strength of headed anchors in tension,* $\mathbf{N_{sb}}$

17.6.4.1 For a single headed anchor with deep embedment close to an edge ($h_{ef} > 2.5c_{a1}$), the nominal side-face blowout strength, N_{sb}, shall be calculated by:

$$N_{sb} = 13c_{a1}\sqrt{A_{brg}}\lambda_a\sqrt{f'_c} \qquad (17.6.4.1)$$

17.6.4.1.1 If c_{a2} for the single headed anchor is less than $3c_{a1}$, the value of N_{sb} shall be multiplied by the factor $(1 + c_{a2}/c_{a1})/4$, where $1.0 \le c_{a2}/c_{a1} \le 3.0$.

17.6.4.2 For multiple headed anchors with deep embedment close to an edge ($h_{ef} > 2.5c_{a1}$) and anchor spacing less than $6c_{a1}$, the nominal strength of those anchors susceptible to a side-face blowout failure, N_{sbg}, shall be calculated by:

$$N_{sbg} = \left(1 + \frac{s}{6c_{a1}}\right)N_{sb} \qquad (17.6.4.2)$$

where s is the distance between the outer anchors along the edge, and N_{sb} is obtained from Eq. (17.6.4.1) without modification for a perpendicular edge distance.

17.6.5 *Bond strength of adhesive anchors in tension,* $\mathbf{N_a}$ *or* $\mathbf{N_{ag}}$

17.6.5.1 Nominal bond strength in tension, N_a of a single adhesive anchor or N_{ag} of an adhesive anchor group satisfying 17.5.1.3.1, shall be calculated by (a) or (b), respectively.

(a) For a single adhesive anchor:

$$N_a = \frac{A_{Na}}{A_{Nao}}\psi_{ed,Na}\psi_{cp,Na}N_{ba} \qquad (17.6.5.1a)$$

(b) For an adhesive anchor group:

$$N_{ag} = \frac{A_{Na}}{A_{Nao}}\psi_{ec,Na}\psi_{ed,Na}\psi_{cp,Na}N_{ba} \qquad (17.6.5.1b)$$

where $\psi_{ec,Na}$, $\psi_{ed,Na}$, and $\psi_{cp,Na}$ are given in 17.6.5.3, 17.6.5.4, and 17.6.5.5, respectively.

17.6.5.1.1 A_{Na} is the projected influence area of a single adhesive anchor or an adhesive anchor group that is approximated as a rectilinear area that projects outward a distance c_{Na} from the centerline of the adhesive anchor, or in the case of an adhesive anchor group, from a line through a row of adjacent adhesive anchors. A_{Na} shall not exceed nA_{Nao}, where n is the number of adhesive anchors in the group that resist tension.

COMMENTARY

R17.6.4 *Concrete side-face blowout strength of headed anchors in tension,* $\mathbf{N_{sb}}$

R17.6.4.1 The design requirements for side-face blowout are based on the recommendations of Furche and Eligehausen (1991) and are applicable to headed anchors that usually are cast-in. Splitting during installation rather than side-face blowout generally governs post-installed anchors and is evaluated by ACI 355.2 requirements.

R17.6.4.2 To calculate nominal side-face blowout strength for multiple headed anchors, only those anchors close to an edge ($c_{a1} < 0.4h_{ef}$) that are loaded in tension should be considered. Their strength is compared to the portion of the tensile load applied to those anchors.

R17.6.5 *Bond strength of adhesive anchors in tension,* $\mathbf{N_a}$ *or* $\mathbf{N_{ag}}$

R17.6.5.1 Evaluation of bond strength applies only to adhesive anchors. Single anchors with small embedment loaded to failure in tension may exhibit concrete breakout failures, while deeper embedments produce bond failures. Adhesive anchors that exhibit bond failures when loaded individually may exhibit concrete failures in a group or in a near-edge condition. In all cases, the strength in tension of adhesive anchors is limited by concrete breakout strength as given by Eq. (17.6.2.1a) and (17.6.2.1b) (Eligehausen et al. 2006a).

The influence of anchor spacing and edge distance on both bond strength and concrete breakout strength must be evaluated for adhesive anchors. The influence of anchor spacing and edge distance on the nominal bond strength of adhesive anchors in tension are included in the modification factors A_{Na}/A_{Nao} and $\psi_{ed,Na}$ in Eq. (17.6.5.1a) and (17.6.5.1b).

The influence of nearby edges and adjacent loaded anchors on bond strength is dependent on the volume of concrete mobilized by a single adhesive anchor. In contrast to the projected concrete failure area concept used in Eq. (17.6.2.1a) and (17.6.2.1b) to calculate the breakout strength of an adhesive anchor, the influence area associated with the bond strength of an adhesive anchor used in Eq. (17.6.5.1a) and (17.6.5.1b) is not a function of the embedment depth, but rather a function of the anchor diameter and characteristic bond stress. The critical distance c_{Na} is assumed the same whether the concrete is cracked or uncracked. For simplicity,