Design Considerations

Ultrabond 365CC and Ultrabond 1 adhesives consist of a resin and a curing agent. Adhesive anchors are often used because of fast curing times compared to cement based grouts. Both Ultrabond products when mixed properly through the mixing nozzle experience an exothermic reaction which forms a polymer matrix bonding to surrounding concrete. The bond generated by the adhesive is accomplished through chemical adherence to the concrete and mechanical bonding with the deformed drill hole wall. When designing adhesive anchor systems, the engineer should be aware of three potential failure modes: ductile steel failure, concrete breakout and bond failure between the adhesive and concrete drill hole wall. Ultrabond 365CC load resistance factors are in accordance with ESR #3770, which complies with ACI 355.4 for testing of epoxy anchor systems. Ultrabond 1 load resistance factors shall be taken as presented in ACI 318-14 Chapter 17, as this product does not have the recognition of the International Code Council (ICC).

1) Definitions

τ_{cr} = Characteristic bond stress for cracked concrete (value found in ESR #3770 for Ultrabond 365CC - for Ultrabond 1 refer to values in ACI 318-14 Chapt. 17 table 17.4.5.2)

τ_{uncr} = Characteristic bond stress for uncracked concrete (value found in ESR #3770 for Ultrabond 365CC - for Ultrabond 1 refer to values in ACI 318-14 Chapt. 17 table 17.4.5.2)

c_{Na} = $10 * d_a * \left(\dfrac{\tau_{uncr}}{1,100\,psi} \right)$ Minimum distance from center of the anchor to open face of concrete
Equation 17.4.5.1d

A_{Na} = See R17.4.5.1a as this area is defined by edge distance and if an anchor group, spacing and group considerations

A_{Nao} = $(2 * c_{Na})^2$ Maximum theoretical area of concrete available - Equation 17.4.5.1c

Ψ_{ed} = Modification factor for edge effects for single adhesive anchors or adhesive anchor groups loaded in tension - Equations 17.4.5.4a and 17.4.5.4b

Ψ_{cp} = Modification factor for adhesive anchors designed for uncracked concrete in accordance with 17.4.5.2 without supplementary reinforcement to control splitting Equations 17.4.5.5a and 17.4.5.5b

e_N = Eccentricity of the adhesive anchor group

Ψ_{ec} = $\dfrac{1}{\left[1 + \left(\dfrac{e_N}{c_{Na}} \right) \right]}$ Modification factor for adhesive anchor groups loaded eccentrically in tension Equation 17.4.5.3

2) Anchor(s) in Tension

$N_{ba} = \tau_{cr} * \pi * d_a * h_{ef}$ Basic bond strength of a single adhesive anchor in cracked concrete Equation 17.4.5.2

$N_{ba} = \tau_{uncr} * \pi * d_a * h_{ef}$ Basic bond strength of a single adhesive anchor in uncracked concrete Equation 17.4.5.2

$N_a = \dfrac{A_{Na}}{A_{Nao}} * \Psi_{ed} * \Psi_{cp} * N_{ba}$ Nominal bond strength of a single anchor in tension - Equation 17.4.5.1a

$N_{ag} = \dfrac{A_{Na}}{A_{Nao}} * \Psi_{ec} * \Psi_{ed} * \Psi_{cp} * N_{ba}$ Nominal bond strength of a anchor group in tension - Equation 17.4.5.1b

*Anchor tensile strength and concrete breakout strength per Page 7
**Anchor shear strength, breakout and pry-out strength per Page 7