

ANEXO D - Cálculo da Variação Uniforme da Temperatura Equivalente aos Efeitos Diferidos

C35/45

HR = 70 % (Humidade Relativa)

$f_{ck} = 35$ MPa

$f_{cm} = 43$ MPa

$t = 20\,000$ dias

$$\bullet \quad \varepsilon_{cs} = \varepsilon_{cd} + \varepsilon_{ca}$$

$$\varepsilon_{cd}(t) = \beta_{ds}(t, ts) \times k_h \times \varepsilon_{cd,0}$$

$$\beta_{ds}(t, ts) \cong 1$$

$$k_h = 0,70$$

$$RH_0 = 100 \%$$

$$\alpha_{ds1} = 4$$

$$\alpha_{ds2} = 0,12$$

$$\varepsilon_{cd,0} = 0,85 \times \left[(220 + 110 \cdot \alpha_{ds1}) \times \exp\left(-\alpha_{ds2} \times \frac{f_{cm}}{f_{cm0}}\right) \right] \times 10^{-6} \times \beta_{RH}$$

$$\beta_{RH} = 1,55 \times \left[1 - \left(\frac{RH}{RH_0}\right)^3 \right] = 1,55 \times \left[1 - \left(\frac{70}{100}\right)^3 \right] = 1,018$$

$$\varepsilon_{cd,0} = 0,85 \times \left[(220 + 110 \times 4) \times \exp\left(-0,12 \times \frac{43}{10}\right) \right] \times 10^{-6} \times 1,018 = 34,10 \times 10^{-5}$$

$$\varepsilon_{cd}(t) = 1,0 \times 0,70 \times 34,10 \times 10^{-5} = 23,87 \times 10^{-5}$$

$$\varepsilon_{ca}(t) = \beta_{as}(t) + \varepsilon_{ca}(\infty)$$

$$\beta_{as}(t) = 1 - \exp(-0,20 \times t^{0,5}) = 1,0$$

$$\varepsilon_{ca}(\infty) = 2,5 \times (f_{ck} - 10) \times 10^{-6} = 6,30 \times 10^{-5}$$

$$\varepsilon_{ca}(t) = 1,0 \times 6,30 \times 10^{-5} = 6,30 \times 10^{-5}$$

$$\varepsilon_{cs} = 23,87 \times 10^{-5} + 6,30 \times 10^{-5} = -30,20 \times 10^{-5}$$

$$\bullet \quad \varepsilon_{cc} = \varphi_c \times \frac{\sigma_c}{E_c}$$

$$\varphi_{c,med} = 2,32$$

$$\sigma_c = \frac{P_0}{A_{med}} = \frac{14125,74}{5,261} = 2,68 \text{ MPa}$$

$$\therefore \varepsilon_{cc} = 2,32 \times \frac{2,68}{34 \times 10^3} = 18,30 \times 10^{-5}$$

$$\bullet \quad \varepsilon_{c0} = \frac{\sigma_c}{E_c}$$

$$\therefore \varepsilon_{c0} = \frac{\sigma_c}{E_c} = \frac{2,68}{34 \times 10^{-3}} = 7,90 \times 10^{-5}$$

$$\bullet \quad \varepsilon = \alpha \cdot \Delta T \Leftrightarrow \Delta T = \frac{\varepsilon}{\alpha}$$

$$\alpha = 10^{-5}$$

$$\therefore \Delta T_{eq} = \frac{(30,20 + 18,30 + 7,90) \times 10^{-5}}{10^{-5}} = 56,40 \text{ }^\circ\text{C}$$