

**Early Thermal Cracking of Concrete**

BD28/87

Base Length L <sub>w</sub> =	11600	mm
Base Thickness T <sub>w</sub> =	1000	mm
Reinforcement Strength f <sub>y</sub> =	500	N/mm <sup>2</sup>
Concrete Strength f <sub>cu</sub> =	40	N/mm <sup>2</sup>



Cement content = 350                      Formwrk : 18mm ply    Season:    Summer

Short-term fall in temperature T<sub>1</sub> = 45                      (+10 for wall>500 thick)

Ac for outer 250mm of wall for 1m length of wall= 500000    mm<sup>2</sup>

Tensile strength of immature concrete f<sub>ct</sub>= 0.12\*f<sub>cu</sub><sup>0.7</sup> = 1.587169 N/mm<sup>2</sup>

Using the prediction method (Section 5.1)

$$\text{Minimum area of reinforcement} = f_{ct} * A_c / f_y = 1587.169 \text{ mm}^2 \dots\dots\dots(2)$$

For crack control:

$$f_{ct}/f_b = 0.67 \quad \text{for Type 2 deformed bars}$$

Permissible crack width w from Table 1 (Pt 4) = 0.25

Ultimate tensile strain of concrete ε<sub>ult</sub>= 200    microstrains

Shrinkage strain of concrete ε<sub>sh</sub>= 0.5\*ε<sub>ult</sub> = 100    microstrains

Clause 5.7 Thermal Strain:

Coefficient of thermal expansion = α = 1.20E-05

Long-term fall in temperature T<sub>2</sub> = 0    (Wall less than 15m long or at same climatic exposure)

Thermal strain of concrete ε<sub>th</sub>= 0.8\*α\*(T<sub>1</sub>+T<sub>2</sub>) = 0.000432

Restraint Factor (from Table 2)= 0.2    (Base cast onto blinding)

Required Reinforcement:

Bar diameter φ = 16    mm

$$A_s = (f_{ct}/f_b) * A_c * \phi * [R * (\epsilon_{sh} + \epsilon_{th}) - 0.5 * \epsilon_{ult}] / (2 * w) = 68.608 \text{ mm}^2/m \dots\dots\dots(3)$$

Height of wall = 150    mm

Length to height ratio = 77.33333333 : 1

Min A<sub>s</sub> required = **1587.169** mm<sup>2</sup>/m

Height for reinforcement = 150    mm

Min A<sub>s</sub> each face = 793.5846 mm<sup>2</sup>/m

Reinforcement = B16 @ 253.4    c/c in each face