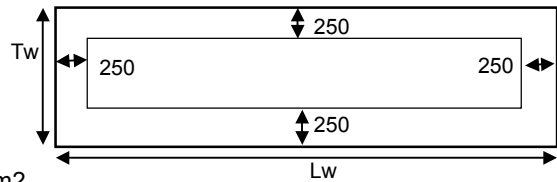


Early Thermal Cracking of Concrete

BD28/87

Wall Length L_w =	11600	mm
Wall Thickness T_w =	1000	mm
Reinforcement Strength f_y =	500	N/mm ²
Concrete Strength f_{cu} =	40	N/mm ²



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

Short-term fall in temperature $T_1 = 45$ (+10 for wall > 500 thick)

A_c for outer 250mm of wall for 1m length of wall = 500000 mm²

Tensile strength of immature concrete $f_{ct} = 0.12 * f_{cu}^{0.7} = 1.587169$ N/mm²

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:

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

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

Ultimate tensile strain of concrete $\epsilon_{ult} = 200$ microstrains

Shrinkage strain of concrete $\epsilon_{sh} = 0.5 * \epsilon_{ult} = 100$ microstrains

Clause 5.7 Thermal Strain:

Coefficient of thermal expansion = $\alpha = 1.20E-05$

Long-term fall in temperature $T_2 = 0$ (Wall less than 15m long or at same climatic exposure)

Thermal strain of concrete $\epsilon_{th} = 0.8 * \alpha * (T_1 + T_2) = 0.000432$

Restraint Factor (from Table 2) = 0.6 (Wall cast onto base)

Required Reinforcement:

Bar diameter $\phi = 16$ mm

$$A_s = (f_{ct}/f_b) * A_c * \phi * [R * (\epsilon_{sh} + \epsilon_{th}) - 0.5 * \epsilon_{ult}] / (2 * w) = 2349.824 \text{ mm}^2/m \dots\dots\dots(3)$$

Height of wall = 6630 mm

Length to height ratio = 1.749622926 : 1

Min A_s required = **2349.824** mm²/m

Height for reinforcement = 3315 mm

Min A_s each face = 1174.912 mm²/m

Reinforcement = B16 @ 171.1 c/c in each face of wall