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State-of-the-Art Report on Temperature-Induced
Deflections of Reinforced Concrete Members
All printings through February 2008
Reported by ACI Committee 435

Example 4, pages 8 and 9 revised as:

Example 4 – Continuous One-Way (Two-Span) Slab-Linear Temperature Gradient

...

(a) D + L...

$$= \left(\frac{2.85}{5.60} \right)^3 (216) + \left[1 - \left(\frac{2.85}{5.50} \right)^3 \right] (59)$$

$$= \left(\frac{2.85}{5.60} \right)^3 (216) + \left[1 - \left(\frac{2.85}{3.15} \right)^3 \right] (59)$$

...

(b) D + L + T...

(i) Thermal moments based on I_g

$$M_T = \left(\frac{3}{2} \right) (3600) (216) \left(\frac{0.0000055 \times 40}{6} \right)$$

$$M_T = \left(\frac{3}{2} \right) (3600) (216) \left(\frac{0.0000055 \times 40}{6} \right) \times \left(\frac{1}{12} \right)$$

$$= \del{7.13} \underline{3.56} \text{ ft.kips/ft.}$$

~~Note that this moment exceeds the negative moment due to dead + live load.~~

At location of maximum positive moment due to dead + live load...

$$M_T = 3/8 \times 7.13 = 2.67 \text{ ft.K} \quad M_T = 3/8 \times 3.56 = 1.34 \text{ ft.K}$$

Max. positive moment for D + L + T

$$= 3.15 + 2.67 = 5.82 \text{ ft.K/ft.} \quad = 3.15 + 1.34 = 4.49 \text{ ft.K/ft.}$$

$$I_e = \left(\frac{2.85}{5.82} \right)^3 (216) + \left[1 - \left(\frac{2.85}{5.82} \right)^3 \right] (59) \quad I_e = \left(\frac{2.85}{4.49} \right)^3 (216) + \left[1 - \left(\frac{2.85}{4.49} \right)^3 \right] (59) \quad (59)$$

$$= 78 \text{ in.}^4 \quad = 103 \text{ in.}^4$$

$$\text{Average } I_e = (79 + 78)/2 = 78.5 \text{ in.}^4 \quad \text{Average } I_e = (79 + 103)/2 = 91 \text{ in.}^4$$

Deflection due to D + L + T

$$\Delta^{\max} = \frac{(0.175)(16^4)(12^3)}{(185)(3600)(78.5)} = 0.37 \text{ in.} \quad \Delta^{\max} = \frac{(0.175)(16^4)(12^3)}{(185)(3600)(91)} = 0.33 \text{ in.}$$

i.e. Temperature gradient results in ~~60%~~ 43% increase in deflection under dead + live load

(ii) Thermal moments based on I_e calculated for service loads

$$M_T = 7.13 \times \frac{127}{216} = 4.19 \text{ ft.kips/ft.} \quad M_T = 3.56 \times \frac{127}{216} = 2.09 \text{ ft.kips/ft.}$$

$$M_T \text{ at } 3/8 L = 1.57 \text{ 0.78 ft.kips/ft.}$$

Therefore maximum positive moment for D + L + T

$$= 3.15 + 1.57 = 4.72 \text{ ft.kips/ft.} \quad = 3.15 + 0.78 = 3.93 \text{ ft.kips/ft.}$$

$$I_e = 93 \text{ in.}^4 \quad I_e = 119 \text{ in.}^4$$

$$\text{Average } I_e = (79 + 93)/2 = 86 \text{ in.}^4 \quad \text{Average } I_e = (79 + 119)/2 = 99 \text{ in.}^4$$

Deflection due to D + L + T

$$\Delta_{\max} = .033 \text{ 0.30 in.}$$

Last revised on 2-27-2008, 9:48 a.m.