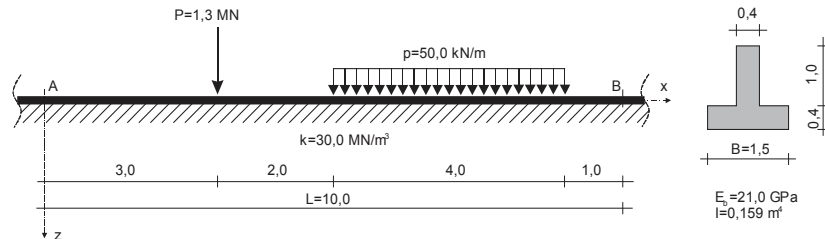


BROJNI PRIMER -1

Potrebno je odrediti uticaje (sleganje w , nagib elastične linije θ , transversalnu silu T i moment savijanja M) u tački A , B i nagib elastične linije ispod koncentrisane sile P , vrlo dugačkog nosača na deformabilnoj podlozi, prema opterećenju i dimenzijama na Slici 4.7. Temeljnu podlogu aproksimirati Vinklerovim modelom. Proračun izvršiti analitički, prema izrazima za beskonačni nosač.



Slika 4.7 Opterećenje između tačaka A i B beskonačnog nosača

Rešenje:

Parametar krutosti sistema temeljni nosač – podloga (tlo), iznosi:

$$\lambda = \sqrt{\frac{kB}{4E_b I}} = \sqrt{\frac{30,0 \cdot 1,5}{4 \cdot 21000 \cdot 0,159}} = 0,2409 \text{ m}^{-1}$$

Proračun sleganja w , nagiba θ , transversalne sile T i momenta savijanja M , u tački A :

- pomoćne veličine za proračun uticaja koncentrisanog opterećenja :

$$\Delta x = x - x_p = 0 - 3,0 = -3,0 \quad \text{sgn}(\Delta x) = \text{sgn}(-3,0) = -1$$

- pomoćne veličine za proračun uticaja od jednako podeljenog opterećenja :

$$\Delta x_L = x - x_L = 0 - 5,0 = -5,0 \quad \Delta x_D = x - x_D = 0 - 9,0 = -9,0$$

$$\text{sgn}(\Delta x_L) = \text{sgn}(-5,0) = -1 \quad \text{sgn}(\Delta x_D) = \text{sgn}(-9,0) = -1$$

$$w_A = \frac{P\lambda}{2Bk} A(3\lambda) + \frac{p}{2Bk} [D(5\lambda) - D(9\lambda)]$$

$$w_A = \frac{1300 \cdot 0,2409}{2 \cdot 1,5 \cdot 30000} A(0,723) + \frac{50,0}{2 \cdot 1,5 \cdot 30000} [D(1,205) - D(2,169)] = 2,48 \cdot 10^{-3} \text{ m}$$

$$\theta_A = \frac{P\lambda^2}{Bk} B(3\lambda) + \frac{p\lambda}{2Bk} [A(5\lambda) - A(9\lambda)]$$

$$\theta_A = \frac{1300 \cdot 0,2409^2}{1,5 \cdot 30000} B(0,723) + \frac{50,0 \cdot 0,2409}{2 \cdot 1,5 \cdot 30000} [A(1,205) - A(2,169)] = 0,586 \cdot 10^{-3} \text{ rad}$$

$$M_A = \frac{P}{4\lambda} C(3\lambda) - \frac{p}{4\lambda^2} [B(5\lambda) - B(9\lambda)]$$

$$M_A = \frac{1300,0}{0,964} C(0,723) - \frac{50,0}{0,232} [B(1,205) - B(2,169)] = 18,028 \text{ kNm}$$

$$T_A = \frac{P}{2} D(3\lambda) + \frac{P}{4\lambda} [C(5\lambda) - C(9\lambda)]$$

$$T_A = \frac{1300,0}{2} D(0,723) + \frac{50,0}{0,964} [C(1,205) - C(2,169)] = 235,914 \text{ kN}$$

Proračun sleganja w , nagiba θ , transverzalne sile T i momenta savijanja M , u tački B :

$$\Delta x = 7,0 \quad \text{sgn}(\Delta x) = 1 \quad \Delta x_L = 5,0 \quad \text{sgn}(\Delta x_L) = 1 \quad \Delta x_D = 1,0 \quad \text{sgn}(\Delta x_D) = 1$$

$$w_B = \frac{P\lambda}{2Bk} A(7\lambda) + \frac{P}{2Bk} [D(5\lambda) - D(\lambda)]$$

$$w_B = \frac{1300 \cdot 0,2409}{2 \cdot 1,5 \cdot 30000} A(1,687) + \frac{50,0}{2 \cdot 1,5 \cdot 30000} [D(1,205) - D(0,241)] = 0,93 \cdot 10^{-3} \text{ m}$$

$$\theta_B = -\frac{P\lambda^2}{Bk} B(7\lambda) + \frac{P\lambda}{2Bk} [A(5\lambda) - A(\lambda)]$$

$$\theta_B = -\frac{1300 \cdot 0,2409^2}{1,5 \cdot 30000} B(1,687) + \frac{50,0 \cdot 0,2409}{2 \cdot 1,5 \cdot 30000} [A(1,205) - A(0,241)] = -0,384 \cdot 10^{-3} \text{ rad}$$

$$M_B = \frac{P}{4\lambda} C(7\lambda) + \frac{P}{4\lambda^2} [B(5\lambda) - B(\lambda)]$$

$$M_A = \frac{1300,0}{0,964} C(1,687) + \frac{50,0}{0,232} [B(1,205) - B(0,241)] = -257,049 \text{ kNm}$$

$$T_\infty = -\frac{P}{2} D(7\lambda) + \frac{P}{4\lambda} [C(5\lambda) - C(\lambda)]$$

$$T_B = -\frac{1300,0}{2} D(1,687) + \frac{50,0}{0,964} [C(1,205) - C(0,241)] = -24,930 \text{ kN}$$

Sleganje w i nagib elastične linije beskonačnog nosača θ ispod sile P :

$$w = \frac{P\lambda}{2Bk} A(0) + \frac{P}{2Bk} [D(2\lambda) - D(6\lambda)]$$

$$w = \frac{1300 \cdot 0,2409}{2 \cdot 1,5 \cdot 30000} 1,00 + \frac{50,0}{2 \cdot 1,5 \cdot 30000} [D(0,482) - D(1,445)] = 3,77 \cdot 10^{-3} \text{ m}$$

$$\theta = \frac{P\lambda^2}{Bk} B(0) + \frac{P\lambda}{2Bk} [A(2\lambda) - A(6\lambda)]$$

$$\theta = \frac{1300 \cdot 0,2409^2}{1,5 \cdot 30000} 0,0 + \frac{50,0 \cdot 0,2409}{2 \cdot 1,5 \cdot 30000} [A(0,482) - A(1,445)] = 0,0765 \cdot 10^{-3} \text{ rad}$$

