

Verification of Shored Member



Description Verification of a stresses and deflections for a beam containing touch and elevated shoring

Beam Properties

| | | |
|-------------------------|-----------------------------|--|
| Beam Length | $L = 50 \text{ ft}$ | $plf = 1 \frac{\text{lbf}}{\text{ft}}$ |
| Initial Elastic Modulus | $E_{ci} = 3586 \text{ ksi}$ | |
| Final Elastic Modulus | $E_{cf} = 4286 \text{ ksi}$ | |

Precast Section Geometry

| | |
|--------------------------------|---|
| Precast height | $h = 32 \text{ in}$ |
| Precast Area | $A_g = 692 \text{ in}^2$ |
| Precast Centroid, from Bottom | $c_{yg} = 22.07 \text{ in}$ |
| Precast Moment of Inertia | $I_{xx.g} = 69359 \text{ in}^4$ |
| Precast Top Section Modulus | $S_{tg} = \frac{I_{xx.g}}{h - c_{yg}} = 6984.7936 \text{ in}^3$ |
| Precast Bottom Section Modulus | $S_{bg} = \frac{I_{xx.g}}{c_{yg}} = 3142.6824 \text{ in}^3$ |

Composite Section Geometry

| | |
|----------------------------------|---|
| Composite Area | $A_c = 1078.4 \text{ in}^2$ |
| Composite Centroid, from Bottom | $c_y = 26.46 \text{ in}$ |
| Composite Moment of Inertia | $I_{xx.c} = 104434 \text{ in}^4$ |
| Composite Top Section Modulus | $S_{tc} = \frac{I_{xx.c}}{h - c_y} = 18850.9025 \text{ in}^3$ |
| Composite Bottom Section Modulus | $S_{bc} = \frac{I_{xx.c}}{c_y} = 3946.8632 \text{ in}^3$ |

Loading

| | |
|-------------------------|-----------------------------|
| Self Weight | $w_{SW} = 720.83 \cdot plf$ |
| Topping Weight | $w_{Dt} = 450 \cdot plf$ |
| Super Imposed Dead Load | $w_{Dc} = 120 \cdot plf$ |
| Live Load | $w_{LL} = 750 \cdot plf$ |

Midspan Moments

Self Weight

$$M_{SW} = \frac{w_{SW} \cdot L^2}{8} = 225.2594 \text{ kip ft}$$

Topping Weight

$$M_{Dt} = \frac{w_{Dt} \cdot L^2}{8} = 140.625 \text{ kip ft}$$

Super Imposed Dead Load

$$M_{Dc} = \frac{w_{Dc} \cdot L^2}{8} = 37.5 \text{ kip ft}$$

Live Load

$$M_L = \frac{w_{LL} \cdot L^2}{8} = 234.375 \text{ kip ft}$$

Touch Shoring Results

Prestressing Properties

Prestress force after losses

$$P_{i.i} = 259.2 \text{ kip}$$

Prestress moment, final, after losses

$$M_{xi.f} = 368.56 \text{ kip ft}$$

Prestress moment, initial, after losses

$$M_{xi.i} = 347.12 \text{ kip ft}$$

Midspan Stresses

Tension at bottom of precast

$$f_b = \frac{P_{i.i}}{A_g} + \frac{M_{xi.i}}{S_{bg}} - \frac{M_{SW}}{S_{bg}} - \frac{(M_{Dt} + M_{Dc} + M_L)}{S_{bc}} = -414.3 \text{ psi}$$

Compression at top of precast

$$f_t = \left(\frac{P_{i.i}}{A_g} - \frac{M_{xi.i}}{S_{tg}} + \frac{M_{SW}}{S_{tg}} + \frac{(M_{Dt} + M_{Dc} + M_L)}{S_{tc}} \right) = 427.8 \text{ psi}$$

Deflections

Self Weight

$$\Delta_{SW} = \frac{5 \cdot w_{SW} \cdot L^4}{384 \cdot E_{ci} \cdot I_{xx.g}} = 0.408 \text{ in}$$

Prestress

$$\Delta_{PS} = \frac{M_{xi.f} \cdot L^2}{8 \cdot E_{ci} \cdot I_{xx.g}} = 0.8 \text{ in}$$

Topping Weight

$$\Delta_{Dt} = \frac{5 \cdot w_{Dt} \cdot L^4}{384 \cdot E_{cf} \cdot I_{xx.c}} = 0.141 \text{ in}$$

Super-Imposed Dead Load

$$\Delta_{Dc} = \frac{5 \cdot w_{Dc} \cdot L^4}{384 \cdot E_{cf} \cdot I_{xx.c}} = 0.038 \text{ in}$$

Live Load

$$\Delta_{LL} = \frac{5 \cdot w_{LL} \cdot L^4}{384 \cdot E_{cf} \cdot I_{xx.c}} = 0.236 \text{ in}$$

Elevated Shoring Results

Prestressing Properties

Prestress force after losses

$$P_{i.i} = 249.8 \text{ kip}$$

Prestress moment, final, after losses

$$M_{xi.f} = 358.58 \text{ kip ft}$$

Prestress moment, initial, after losses

$$M_{xi.i} = 334.46 \text{ kip ft}$$

Midspan Stresses

Tension at bottom of precast

$$f_b = \frac{P_{i.i}}{A_g} + \frac{M_{xi.i}}{S_{bg}} - \frac{(M_{SW} + M_{Dt} + M_{Dc} + M_L)}{S_{bc}} = -301 \text{ psi}$$

Compression at top of precast

$$f_t = \left(\frac{P_{i.i}}{A_g} - \frac{M_{xi.i}}{S_{tg}} + \frac{(M_{SW} + M_{Dt} + M_{Dc} + M_L)}{S_{tc}} \right) = 192.4 \text{ psi}$$

Deflections

Self Weight

$$\Delta_{SW} = \frac{5 \cdot w_{SW} \cdot L^4}{384 \cdot E_{cf} \cdot I_{xx.c}} = 0.226 \text{ in}$$

Prestress

$$\Delta_{PS} = \frac{M_{xi.f} \cdot L^2}{8 \cdot E_{ci} \cdot I_{xx.g}} = 0.779 \text{ in}$$

Topping Weight

$$\Delta_{Dt} = \frac{5 \cdot w_{Dt} \cdot L^4}{384 \cdot E_{cf} \cdot I_{xx,c}} = 0.141 \text{ in}$$

Super-Imposed Dead Load

$$\Delta_{Dc} = \frac{5 \cdot w_{Dc} \cdot L^4}{384 \cdot E_{cf} \cdot I_{xx,c}} = 0.038 \text{ in}$$

Live Load

$$\Delta_{LL} = \frac{5 \cdot w_{LL} \cdot L^4}{384 \cdot E_{cf} \cdot I_{xx,c}} = 0.236 \text{ in}$$