CHAPTER 7

7.2-1. (a) $\delta_{\max} = 0.0321\left(\frac{M_0L^2}{EI}\right)$,

(b) $R_A = -\frac{4M_0}{L}$, $R_B = \frac{4M_0}{L}$, $M_A = 2M_0$

7.2-3. (a) $P_A = \frac{w_0L}{8}$, (b) $R_B = \frac{7w_0L}{8}$, $M_B = \frac{-3w_0L^2}{8}$

7.3-1. (a) $v(x) = \frac{M_0L^2}{6EI}\left[-\left(\frac{x}{L}\right)^3 + \left(\frac{x}{L}\right)\right]$,

(b) $\theta_A = \frac{M_0L}{6EI}$, (c) $\delta_{\max} = \frac{\sqrt{3}\,M_0L^2}{27EI}$

7.3-3. (a) $M_A = 59.7$ kip · ft, (b) $\sigma_{\max} = 20.2$ ksi

7.3-5. (a) $v(x) = \frac{w_0L^4}{120EI}\left[-\left(\frac{L-x}{L}\right)^5 - 5\left(\frac{x}{L}\right) + 1\right]$,

(b) $\theta_B \equiv |v'(L)| = \frac{w_0L^3}{24EI}$, $\delta_B \equiv |v(L)| = \frac{w_0L^4}{30EI}$

7.3-7. (a) $v_1(x) = \frac{WL^3}{3EI}\left[-\left(\frac{x}{L}\right)^3 + \frac{1}{9}\left(\frac{x}{L}\right)\right]$,

$v_2(x) = \frac{WL^3}{6EI}\left[\left(\frac{x}{L}\right)^3 - 3\left(\frac{x}{L}\right)^2 + \frac{11}{9}\left(\frac{x}{L}\right) - \frac{1}{9}\right]$,

(b) $\delta_C = |v_2(L)| = \frac{4WL^3}{27EI}$, (c) $\delta_{\max} = \frac{2\sqrt{3}}{(27)^2}\frac{WL^3}{EI}$

7.3-9. (a) $v_1(x) = \frac{PL^3}{9EI}\left[\left(\frac{x}{L}\right)^3 - 5\left(\frac{x}{L}\right)\right]$,

$v_2(x) = \frac{PL^3}{18EI}\left[2\left(\frac{x}{L}\right)^3 - 3\left(\frac{x-L}{L}\right)^3 - 10\left(\frac{x}{L}\right)\right]$,

(b) $\delta_{\max} = \frac{16\sqrt{6}}{81}\left(\frac{PL^3}{EI}\right)$

7.3-11. (a) $v_1(x) = \frac{w_0L^4}{24EI}\left[-\left(\frac{x}{L}\right)^3 + 4\left(\frac{x}{L}\right)\right]$,

$v_2(x) = \frac{w_0L^4}{24EI}\left[-\left(\frac{x}{L}\right)^4 + 12\left(\frac{x}{L}\right)^3 - 54\left(\frac{x}{L}\right)^2\right.$

$\left.+96\left(\frac{x}{L}\right) - 56\right]$, (b) $\delta_C = \frac{11w_0L^4}{24EI}$,

(c) $\delta_{\max} = \frac{2\sqrt{3}}{27}\left(\frac{w_0L^4}{EI}\right)$

7.3-13. (a) $v(x) = \frac{w_0L^4}{960EI}\left[-16\left(\frac{x}{L}\right)^5 + 40\left(\frac{x}{L}\right)^3\right.$

$\left.-25\left(\frac{x}{L}\right)\right]$, (b) $\delta_{\max} = \frac{w_0L^4}{120EI}$

7.3-15. (a) $v_1(x) = \frac{p_0L^4}{48EI}\left[-4\left(\frac{x}{L}\right)^3 + 9\left(\frac{x}{L}\right)^2\right]$,

$v_2(x) = \frac{p_0L^4}{384EI}\left[16\left(\frac{x}{L}\right)^4 - 64\left(\frac{x}{L}\right)^3 + 96\left(\frac{x}{L}\right)^2\right.$

$\left.-8\left(\frac{x}{L}\right) + 1\right]$, (b) $\delta_C = \frac{41p_0L^4}{384EI}$

7.3-17. (a) $v_1(x) = \frac{PL^3}{96EI}\left[16\left(\frac{x}{L}\right)^3 - 36\left(\frac{x}{L}\right) + 23\right]$,

$v_2(x) = \frac{PL^3}{24EI}\left[4\left(\frac{x}{L}\right)^3 - 3\left(\frac{x}{L}\right)^2 - 6\left(\frac{x}{L}\right) + 5\right]$,

(b) $\delta_A = \frac{23}{96}\frac{PL^3}{EI}$

7.3-19. $h = 4.00$ in. **7.3-21.** $h = 66.7$ mm

7.3-23. (a) $\delta_{\max} = 0.1452$ in., (b) $\sigma_{\max} = 8.14$ ksi

7.3-25. $\sigma_{\max} = 19.44$ MPa

7.3-27. (a) $v(x) = \frac{-w_0}{EI}\left(\frac{L}{\pi}\right)^4 \sin\left(\frac{\pi x}{L}\right)$,

(b) $\theta_B = \frac{w_0}{EI}\left(\frac{L}{\pi}\right)^3$

7.3-29. $v(x) = \frac{p_0L^4}{360EI}\left[-\left(\frac{x}{L}\right)^6 + 15\left(\frac{x}{L}\right)^4 - 40\left(\frac{x}{L}\right)^3 + 45\left(\frac{x}{L}\right)^2\right]$

(b) $\theta_B = \frac{p_0L^3}{15EI}$, (c) $R_A = \frac{2}{3}p_0L$, $M_A = \frac{1}{4}p_0L^2$

7.3-31. (a) $v(x) = \frac{M_0L^2}{6EI}\left[\left(\frac{x}{L}\right)^3 + 3\left(\frac{x}{L}\right)^2 - 4\left(\frac{x}{L}\right)\right]$,

(b) $\theta_B = \frac{5}{6}\frac{M_0L}{EI}$, (c) $\delta_{\max} = 0.1881\frac{M_0L^2}{EI}$

7.3-33. (a) $v(x) = \frac{w_0L^4}{120EI}\left[-\left(\frac{L-x}{L}\right)^5 - 5\left(\frac{x}{L}\right) + 1\right]$,

(b) $\theta_B \equiv |v'(L)| = \frac{w_0L^3}{24EI}$, $\delta_B \equiv |v(L)| = \frac{w_0L^4}{30EI}$

7.3-35. (a) $v_1(x) = \frac{PL^3}{9EI}\left[\left(\frac{x}{L}\right)^3 - 5\left(\frac{x}{L}\right)\right]$,

$v_2(x) = \frac{PL^3}{18EI}\left[-\left(\frac{x}{L}\right)^3 + 9\left(\frac{x}{L}\right)^2 - 19\left(\frac{x}{L}\right) + 3\right]$,

(b) $\delta_{\max} = \frac{16\sqrt{6}}{81}\left(\frac{PL^3}{EI}\right)$

7.3-37. (a) $\delta_B = \frac{11p_0L^4}{120EI}$, (b) $L = \sqrt{\frac{20Eh\delta_{\text{allow}}}{11\sigma_{\text{allow}}}}$