" "FORMULAS FOR FIXED CIRCULAR PLATES"

$$\sigma_r = \frac{6M_r}{t^2} \quad ; \quad \sigma_\phi = \frac{6M_\phi}{t^2}$$

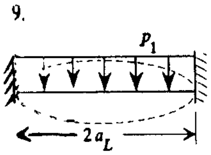
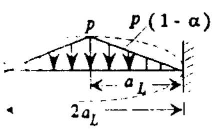
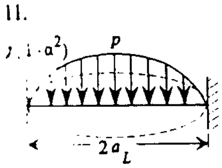
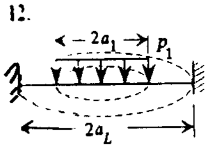
Ref: FORMULAS FOR STRESS, Strain + Structural Matrices, Pilkey, Wall 1994

TABLE 18-3 DEFLECTIONS AND INTERNAL FORCES FOR CIRCULAR PLATES WITH AXIALLY SYMMETRIC LOADS AND BOUNDARY CONDITIONS

Notation

w = deflection
M_r, M_ϕ = bending moments per unit length
r = radial coordinate
a_L = radius of outer boundary
$\alpha = r/a_L$
$D = Eh^3/[12(1-\nu^2)]$
Q_r = transverse shear force per unit length
ν = Poisson's ratio
a_1 = radial location of loading
$\beta = a_1/a_L$
p, p_1 = distributed loading (F/L^2)

WITH AXIALLY SYMMETRIC LOADS AND BOUNDARY CONDITIONS

Structural System and Static Loading	Deflection and Internal Forces
9. 	$w = \frac{p_1 a_L^4}{64D}(1-\alpha^2)^2$ $M_r = \frac{1}{16} p_1 a_L^2[1+\nu-(3+\nu)\alpha^2]$ $M_\phi = \frac{1}{16} p_1 a_L^2[1+\nu-(1+3\nu)\alpha^2]$ $Q_r = -\frac{1}{2} p_1 a_L \alpha$ ✓
10. 	$w = \frac{pa_L^4}{14{,}400D}(129-290\alpha^2+225\alpha^4-64\alpha^5)$ $(M_r)_{\alpha=0} = (M_\phi)_{\alpha=0} = \frac{29pa_L^2}{720}(1+\nu)$ $(Q_r)_{\alpha=1} = -\frac{1}{6}pa_L \quad (M_r)_{\alpha=1} = (M_\phi)_{\alpha=1} = -\frac{7pa_L^2}{120}$
11. 	$w = \frac{pa_L^4}{576D}(7-15\alpha^2+9\alpha^4-\alpha^6)$ $M_r = \frac{1}{96}pa_L^2[5(1+\nu)-6(3+\nu)\alpha^2+(5+\nu)\alpha^4]$ $M_\phi = \frac{1}{96}pa_L^2[5(1+\nu)-6(1+3\nu)\alpha^2+(1+5\nu)\alpha^4]$ $Q_r = -\frac{1}{4}pa_L(2\alpha-\alpha^3)$
12. 	If $\alpha \leq \beta$, $w = \frac{p_1 a_L^4}{64D}[C_1 + 2C_2(1-\alpha^2)+\alpha^4]$ where $C_1 = 4\beta^2 - 5\beta^4 + 8\beta^2 \ln\beta + 4\beta^4 \ln\beta$ $C_2 = \beta^2(\beta^2 - 4\ln\beta)$ ✓ $M_r = \frac{p_1 a_L^2}{16}[(1+\nu)(\beta^4 - 4\beta^2\ln\beta)-(3+\nu)\alpha^2]$ $M_\phi = \frac{p_1 a_L^2}{16}[(1+\nu)(\beta^4 - 4\beta^2\ln\beta)-(1+3\nu)\alpha^2]$ $Q_r = -\frac{p_1 a_1}{2}\frac{\alpha}{\beta}$