3.12 Design Aids

Design Aid 3.12.1 Design Strength Interaction Curves for Precast, Prestressed Concrete Columns

**CRITERIA**
1. $f'_c = 5000$ psi, normalweight
2. Minimum prestress = 225 psi
3. All strand assumed $\frac{1}{2}$ in. diameter, $f_{pu} = 270$ ksi
4. Curves shown for partial development of strand near member end where $f_{pu} = f_{sa}$
5. Horizontal portion of curve is the maximum for tied columns = $0.80 \phi P_o$
6. Varies linearly from 0.9 for tension-controlled sections to 0.65 for compression-controlled sections in accordance with ACI 318-05 Section 9.3.2

**USE OF CURVES**
1. Enter at left with applied factored axial load $P_o$
2. Enter at bottom with applied magnified factored moment $\delta M_u$
3. Intersection point must be to the left of curve indicating required concrete strength.

**NOTATION**
- $\phi P_n$ = design axial strength
- $\phi M_n$ = design flexural strength
- $\phi P_o$ = design axial strength at zero eccentricity
- $A_g$ = gross area of the column
- $\delta$ = moment magnifier (ACI 318-05, Section 10.11–10.13)
Design Aid 3.12.1  Design Strength Interaction Curves for Precast, Prestressed Concrete Columns (cont.)

- **20 x 20**
  - 4 Strands
  - Full Development
  - Partial Development

- **24 x 24**
  - 8 strands
  - $f'_c = 10,000$ psi
  - $f'_c = 9000$ psi
  - $f'_c = 8000$ psi
  - $f'_c = 7000$ psi
  - $f'_c = 6000$ psi
  - $f'_c = 5000$ psi

- **28 x 28**
  - 8 strands
  - $f'_c = 10,000$ psi
  - $f'_c = 9000$ psi
  - $f'_c = 8000$ psi
  - $f'_c = 7000$ psi
  - $f'_c = 6000$ psi
  - $f'_c = 5000$ psi

- **32 x 32**
  - 12 strands
  - $f'_c = 10,000$ psi
  - $f'_c = 9000$ psi
  - $f'_c = 8000$ psi
  - $f'_c = 7000$ psi
  - $f'_c = 6000$ psi
  - $f'_c = 5000$ psi