

### Structural & transportation

#### ✔ Concrete

$$\phi M_n \geq M_u$$

$$f_s = Mc/I$$

#### ✔ Steel

$$M_p = ZF_y$$

$$V_n = 0.6F_y A_w$$

#### ✔ Transportation

$$SSD = 1.47 V t + \frac{V^2}{30(f \pm G)}$$

$$R = \frac{V^2}{15(e + f)}$$

$$q = kv$$

### Environmental & economy

#### ✔ Water treatment

$$BOD_t = L_0 (1 - e^{-kt})$$

$$\text{Hardness} = mg/L * 50 / EW$$

$$pH = -\log(H^+)$$

#### ✔ Sedimentation

$$v = \frac{g(\rho_p - \rho_w) d^2}{18\mu}$$

$$OR = \frac{Q}{A}$$

#### ✔ Activated sludge

$$F/M = Q S_0 / V X$$

$$\theta_c = MLSS / \text{waste rate}$$

#### ✔ Disinfection

$$Ct = \text{constant}$$

#### ✔ Engineering economy

$$F = P(1+i)^n$$

$$P = F/(1+i)^n$$

$$P = A \frac{[(1+i)^n - 1]}{i(1+i)^n}$$