混凝土结构：平面布设系统

http://nisee.berkeley.edu/godden
Reinforced Concrete Design

- economical & common
- resist lateral loads
Reinforced Concrete Design

• **flat plate**
  - 5”-10” thick
  - simple formwork
  - lower story heights

• **flat slab**
  - same as plate
  - 2 ¼”–8” drop panels
Reinforced Concrete Design

• beam supported
  – slab depth ~ L/20
  – 8”–60” deep

• one-way joists
  – 3”–5” slab
  – 8”–20” stems
  – 5”–7” webs
Reinforced Concrete Design

- **two-way joist**
  - “waffle slab”
  - 3”-5” slab
  - 8”-24” stems
  - 6”-8” webs

- **beam supported slab**
  - 5”-10” slabs
  - taller story heights
Reinforced Concrete Design

- simplified frame analysis
  - strips, like continuous beams

- moments require flexural reinforcement
  - top & bottom
  - both directions of slab
  - continuous, bent or discontinuous
Reinforced Concrete Design

• one-way slabs (wide beam design)
  – approximate analysis for moment & shear coefficients
  – two or more spans
  – ~ same lengths
  – \( w_u \) from combos
  – uniform loads with \( L/D \leq 3 \)
  – \( \ell_n \) is clear span (+M) or average of adjacent clear spans (-M)

*Figure 2-2 Conditions for Analysis by Coefficients (ACI 8.3.3)*
Reinforced Concrete Design

Figure 2-3 Positive Moments—All Cases

Figure 2-4 Negative Moments—Beams and Slabs
Shear in Concrete

- at columns
- want to avoid stirrups
- can use shear studs or heads
Shear in Concrete

- critical section at d/2 from
  - column face, column capital or drop panel
Shear in Concrete

• at columns with waffle slabs
Openings in Slabs

- **careful placement of holes**
- shear strength reduced
- bending & deflection can increase

*Figure 18-11 Openings in Slab Systems without Beams*
General Beam Design

- \( f_c' \) & \( f_y \) needed
- usually size just \( b \) & \( h \)
  - even inches typical (forms)
  - similar joist to beam depth
  - \( b:h \) of 1:1.5-1:2.5
  - \( b_w \) & \( b_f \) for \( T \)
  - to fit reinforcement + stirrups
- slab design, \( t \)
  - deflection control & shear

\[
S = \frac{b h^2}{6}
\]
General Beam Design (cont’d)

- custom design:
  - longitudinal steel
  - shear reinforcement
  - detailing