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

• 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)

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
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

Openings in Slabs

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

$$S = \frac{bh^2}{6}$$

General Beam Design (cont’d)

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

Figure 14.6: Common shapes for beams.