11 SMRF

- Joint Shear
- Anchorage
- Column Shear
- $\sum M_{nc} \geq \frac{6}{5} \sum M_{nb}$ (Check one floor below roof)

Columns

SEE JOINT SECTION

Beams

Shear

$V_u = f(M_pr)$

$V_c = 0$ in plastic hinge regions.

12 Walls

δ_c Wall displacement capacity at top of wall

Resistance Factors

Axial/Moment:
$\phi = 0.65 - 0.9$

Shear:
$\phi = 0.75$, For V_u amplified by Ω_v
$\phi = 0.60$ if $V_n < V(M_n)$
for squat walls, take $\phi = 0.6$

Coupling beam shear:
$\phi = 0.85$ diagonally reinforced
$\phi = 0.75$ otherwise

13.4 Behavioral Observations

Slender vs Squat

Flexural Response

Lateral stability

$\lambda_c = \frac{c}{b}\frac{l_w}{b} > 40$

$b \geq \sqrt{0.025 c l_w}$ **for SBEs**.

Dynamic response

Preliminary Proportioning for V_b

assume $l_{be} = 0.2 l_w$

Detailing

long. bar fracture:
$A_s f_y \geq A_{be} f_r \therefore \rho_l \geq 6\sqrt{f'_c}/f_y$

Cut-offs:
$0.8 l_w$ or l_d above next floor

No-splice zone:
min($20'$, $h_{1^{st}\, floor}$)

Slender Walls w/ C. Section

Distributed rebar

$\rho_l, \quad \rho_t = \frac{2A_{si}}{ts} \geq 0.0025$ if $V_u \geq \lambda A_{cv}\sqrt{f'_c}$ (18.10.2.1)

Boundary Elements

SEE NOTES PAGE 163 B.E. FRACTURE

Shear

$V_u = \frac{M_n[P_u]}{M_u}\omega_v V_{code}$

SBE

Required if
$c \geq \dfrac{l_w}{900(\delta_u/h_w)} \quad \text{or} \quad \sigma \geq \dfrac{f'_c}{5}$

use given graph to determine c.

for min. height of $h_{be} = \max(l_w, \frac{M_{u,cs}}{4V_{u,cs}})$

- $A_{sh} \geq 0.09sb_c\frac{f'_c}{f_y} \geq 0.3\left(\frac{A_g}{A_{ch}} - 1\right)sb_c\frac{f'_c}{f_y}$
-

13.9 Walls w/o C. Section

13.10.1 Conventional Squat Walls

13.16 - Openings

Tie region: $A_s = T_u/\phi f_y$
Strut region: $P_u \leq \phi P_o$

$\phi = 0.65$ in wall piers
$\phi = 0.60$ for wall shear
$\phi = 0.75$ otherwise

13.12 Coupled Walls

Coupling beams

$$V_n = 2A_{vd}f_y\sin\alpha \leq 10\sqrt{f'_c}A_{cw}$$

- ϕ for A_{tr} is 0.75

Wall Piers

$P_u = 1.2P_D + 0.5P_L + n_sP_E$

13 Gravity Framing

Columns

Confinement

if $P_u \geq 0.35A_gf'_c$:

- Support all bars with 135^o hook.
- $\frac{A_{sh}}{sb_c} \geq 0.3..., 0.09..., 0.2...$

Shear

$V_u = f(M_{pr}(P_u))$, often $\frac{2M_{pr}}{l_w}$

Beams

FIGURE FROM NOTES PAGE 200

Slabs

$V_n = 4\lambda_s\sqrt{f'_c}b_od$

DRIFT CAPACITY

14 Diaphragms

Moment

$M_u = \dfrac{wl^2}{8} \leq \phi M_n = 0.9(A_sf_y0.9d)$

$T_u = C_u = \frac{M_u}{jd}$

$T_u \leq Tn = 0.9A_sfy$

$C_u \leq \phi\alpha P_{no} = (0.65)(0.8)(A_sf_y + 0.85A_cf'_c)$

Collectors

Shear friction

$$\Omega_o V_u \leq \underbrace{\phi}_{0.75} \underbrace{\mu}_{1.4} A_{sf} f_y$$

- Give A_{sf} as in^2/ft

Openings

Comp. Zones

- Confine if $\frac{C}{A} \geq 0.2 f_c'$