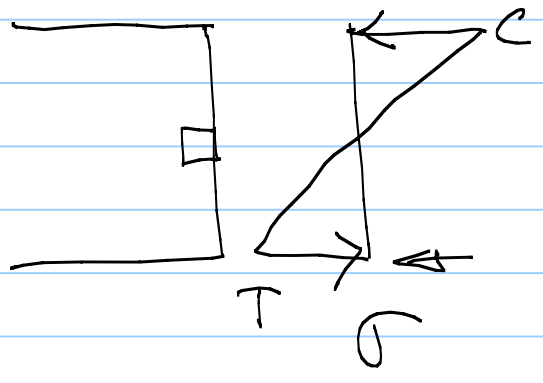
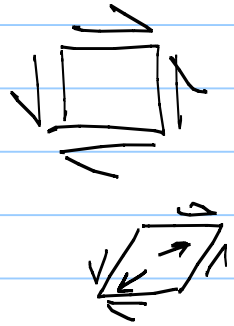
Note Title 4/19/2007

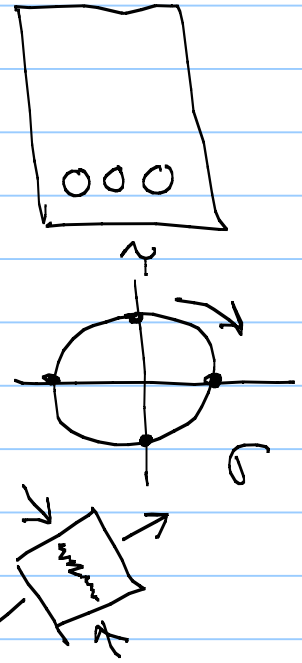
HW # 8 Due Tuesday 4/24

Senior Design Presentation 4/23
140 Smith 6:00 PM
Food @ 5:45 PM

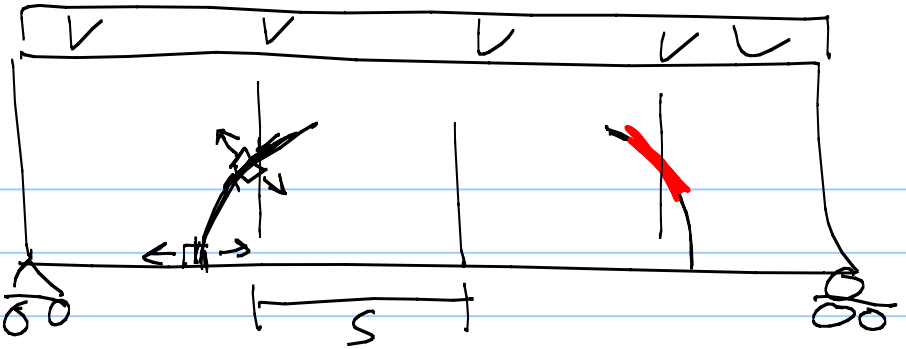
CH 8 Concrete in Shear

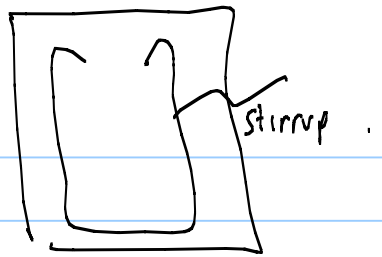






diagonal tension failure

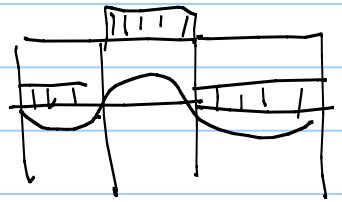




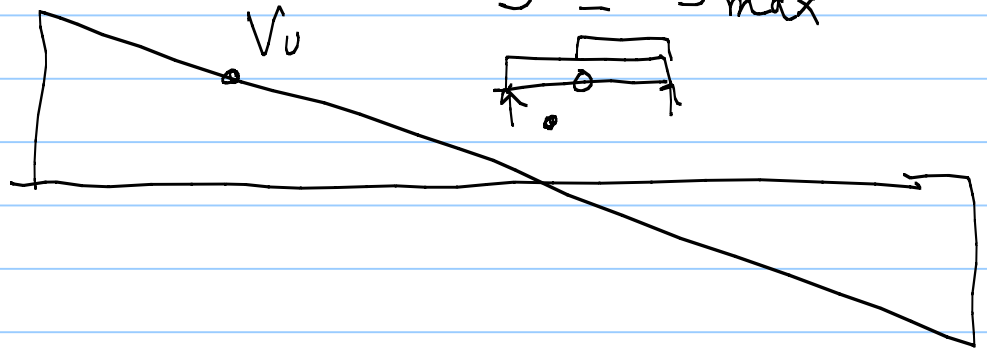
Do we need shear reinforcement of can the concrete carry all of the shear

If you need stirrups, what should the spacing be

#3, #4



$$S \leq S_{max}$$



$V_U \leq \phi V$ → $V_c + V_s = V$

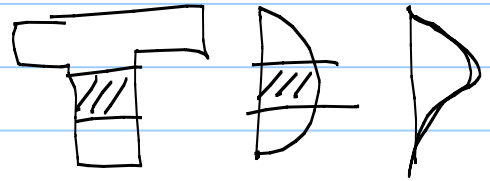
$\phi_{shear} = 0.75$

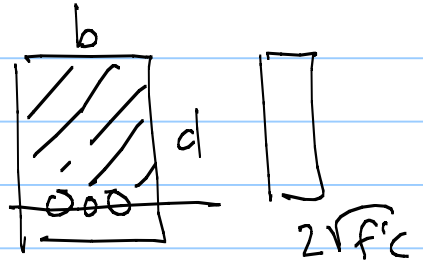
brittle failure

ACI 11-3 $V_c = 2\sqrt{f'_c}\, b_w d$

Ave σ Area

b_w - width of web





$V_c = [lb]$

$f'_c = [psi]$

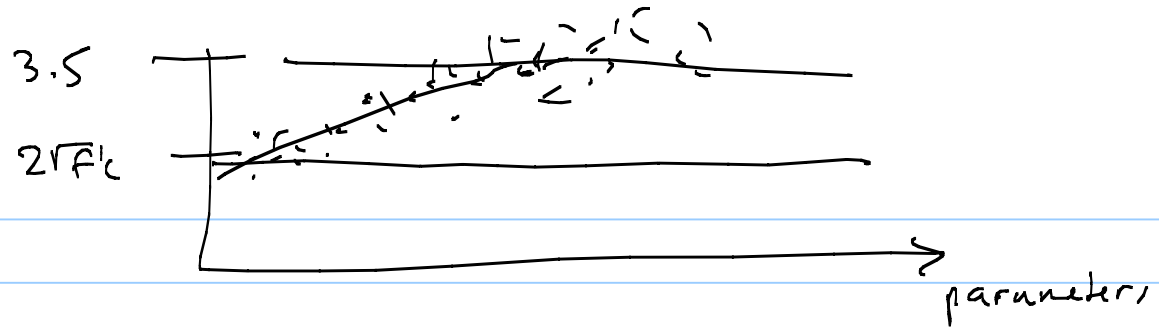
$2\sqrt{f'_c}$ (3000 psi)

$= 109$ psi

σ

ACI 11-5 $V_c = \left[1.9\sqrt{f'_c} + 2500\rho_w \frac{V_u d}{M_u}\right] b_w d$

$\leq 3.5\sqrt{f'_c}\, b_w d$



$\rho_w \uparrow$

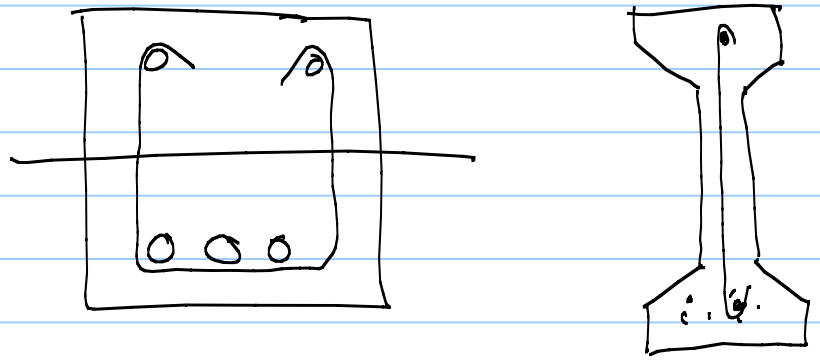
$\frac{V_v}{M} \uparrow$

more capacity

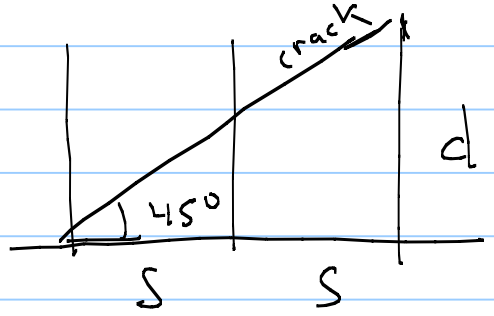
cracks stay closed

More V_c

8.6 Web Reinforcement



Shear Capacity Stirrup ?



$ns = d$

$n = d/s$

force = $Avfy$

$V_s = Avfy\ n$

n- # of stirrups intersected by crack

$$V_s = \frac{Avfy\ d}{s}$$

$$s = \frac{Avfyd}{V_s}$$

$= 2\sqrt{f'c}\ bw\ d$

8.8 Design

$V_v \leq \phi V_n$

$V_u \leq \phi V_c + \phi V_s$

$\phi = 0.75$

50

$V_c = 40$
$V_c = \phi 0$

Need Stirrups if $V_u > \frac{1}{2}\phi V_c$

Code

$\phi V_c + \phi V_s \geq V_u$

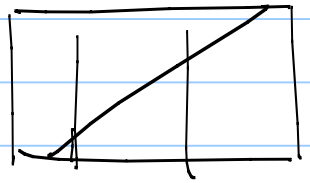
$V_s = \frac{V_u - \phi V_c}{\phi}$

Smax

crack intersects at least 2 stirrups

$S_{max} \leq d/2$ → $d/4$ if $2V_c < V_s < 4V_c$

$V_s > 4V_c$ can't do this



$A_{v\,min} \geq \frac{50 b_w S_{max}}{f_y}$

$\geq \frac{0.75\sqrt{f'_c}\, b_w S_{max}}{f_y}$

$V_c = 2\sqrt{f'_c}$ (109)

γ_s — 50 (50) $S_{max} \leq \dfrac{A_v f_y}{50 b_w}$ [psi]

γ_s — $0.75\sqrt{f'_c}$ (41) $\leq \dfrac{A_v f_y}{0.75\sqrt{f'_c}\, b_w}$ ← f'_c

equiv. steel stress over area $b_w d$

Table 8.1

Steps 1 + 2 find V_u

Step 3 Calculate $\phi V_c = \phi 2\sqrt{f'_c}\, b_w d$

Step 4 Do you need stirrups? $V_u \geq \frac{1}{2}\phi V_c$

↓

Need Stirrups

Step 1 find $V_s = \frac{V_u - \phi V_c}{\phi}$ (neg)

Step 2 find S_{max} $V_{s_{max}}$

$S_{max} \leq d/2$ $\quad V_s < 2V_c$ $\quad (2\sqrt{f'_c})bd$

$\leq d/4$ $\quad 2V_c < V_s < 4V_c$

$\leq \frac{A_v f_y}{50 b_w}$

$\leq \frac{A_v f_y}{0.75\sqrt{f'_c} b_w}$

Step 3 $V_{s_{max}}$ is $\phi V_c + \phi V_{s_{max}} > V_u$

$V_s = \frac{A_v f_y d}{s}$ if

if S_{max} ($V_{s_{max}}$) not enough

Step 4 $S = \dfrac{A_v f_y d}{V_s}$ ←