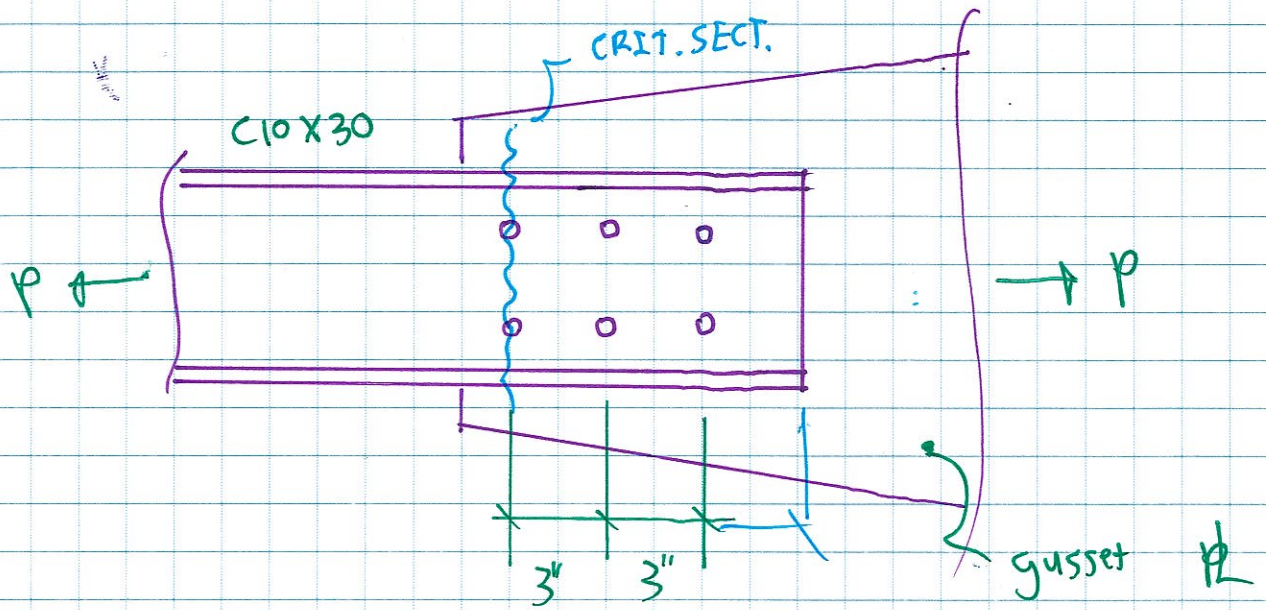
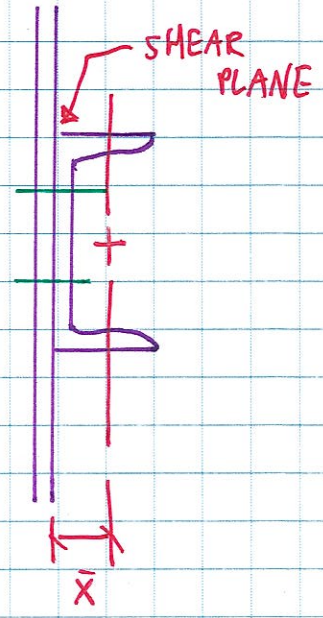
EXAMPLE

GIVEN: A Channel Section, C10 X 30, is connected to a gusset PL w/ 7/8" ϕ bolts





REQ'D Compute A_n & A_e

SOLN C10X30: $A_g = 8.81\ in^2$, $t_w = 0.673\ in$, $\bar{x} = 0.649\ in$ } p1-38 AISC

MITTENS
BUTTERSCOTCH
MANGO
ROSCO
KEVIN

$$A_n = A_g - \Sigma A_{hole} = 8.81\ in^2 - (2\ holes)(0.673")\left(\frac{7}{8}" + \frac{1}{16}" + \frac{1}{16}"\right) = \underline{7.464\ in^2}$$

t_w ; tolerance ; damage

$$A_e = UA_n$$

$$U = 1 - \frac{\bar{x}}{\ell} \qquad \text{(case 2)}$$

$$\bar{U} = 1 - \frac{0.673"}{6"} = 0.89$$

$$A_e = 0.89\left(7.464\ in^2\right) = \underline{6.643\ in^2}$$

CHAP B AISC (p16.1-12) "DESIGN REQUIREMENTS"

$R_u = \phi R_n$ ← Nominal Strength (Moment, Shear, Tension, Axial, etc.)

ϕ DESIGN STRENGTH

Replace R w/ P, V, or M

APPLICABLE LIMIT STATES: Tension Members

AISC CHAP D & J ← BSR (connection related)

D Tension

D2 TENSILE STRENGTH

GROSS-SECTION YIELDING (GSY)

$P_u = \phi P_n$

$P_u = \phi f_y A_g$ ← Gross CSA

f_y yield strength

$\phi_t = 0.9$

NET SECTION RUPTURE (NSR)

$P_u = \phi P_n$

$P_u = \phi f_u A_e$ ← net eff. area

↑ ult. strength

$\phi_t = 0.75$

Smallest value for GSY or NSR will control P_u

(add BSR later)

EXAMPLE

GIVEN: The same C10X30 used prev. w/ A36 material

REQ'D: The design capacity of the channel, neglect BSR

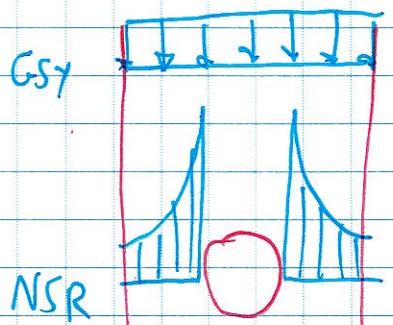
SOLN: C10X30: $A_g = 8.81\ in^2$, $A_e = 6.643\ in^2$ } from example

A36: $f_y = 36\ ksi$, $f_u = 58 - 80\ ksi$ } p2-48

GSY: $P_u = \phi f_y A_g = 0.9(36\ ksi)(8.81\ in^2) = 285.4\ k$ ← GSY controls

NSR: $P_u = \phi f_u A_e = 0.75(58\ ksi)(6.643\ in^2) = 289\ k$

$\phi_t P_n = 285.4^k$



BLOCK SHEAR RUPTURE (BSR)

AISC CHAP J4.3, p16.1-138

take the min. value NSR

$$\phi P_n = \phi\left[0.6 f_u A_{nv} + U_{bs} F_u A_{nt}\right] \leq \phi\left[0.6 f_y A_{gv} + U_{bs} F_u A_{nt}\right] \quad \text{(J4-5)}$$

$0.6 f_u A_{nv}$: ult. shear strength

$U_{bs} F_u A_{nt}$

$0.6 f_y A_{gv}$: shear yield strength

where:

$\phi_t = 0.75$

A_{nv} = net shear area

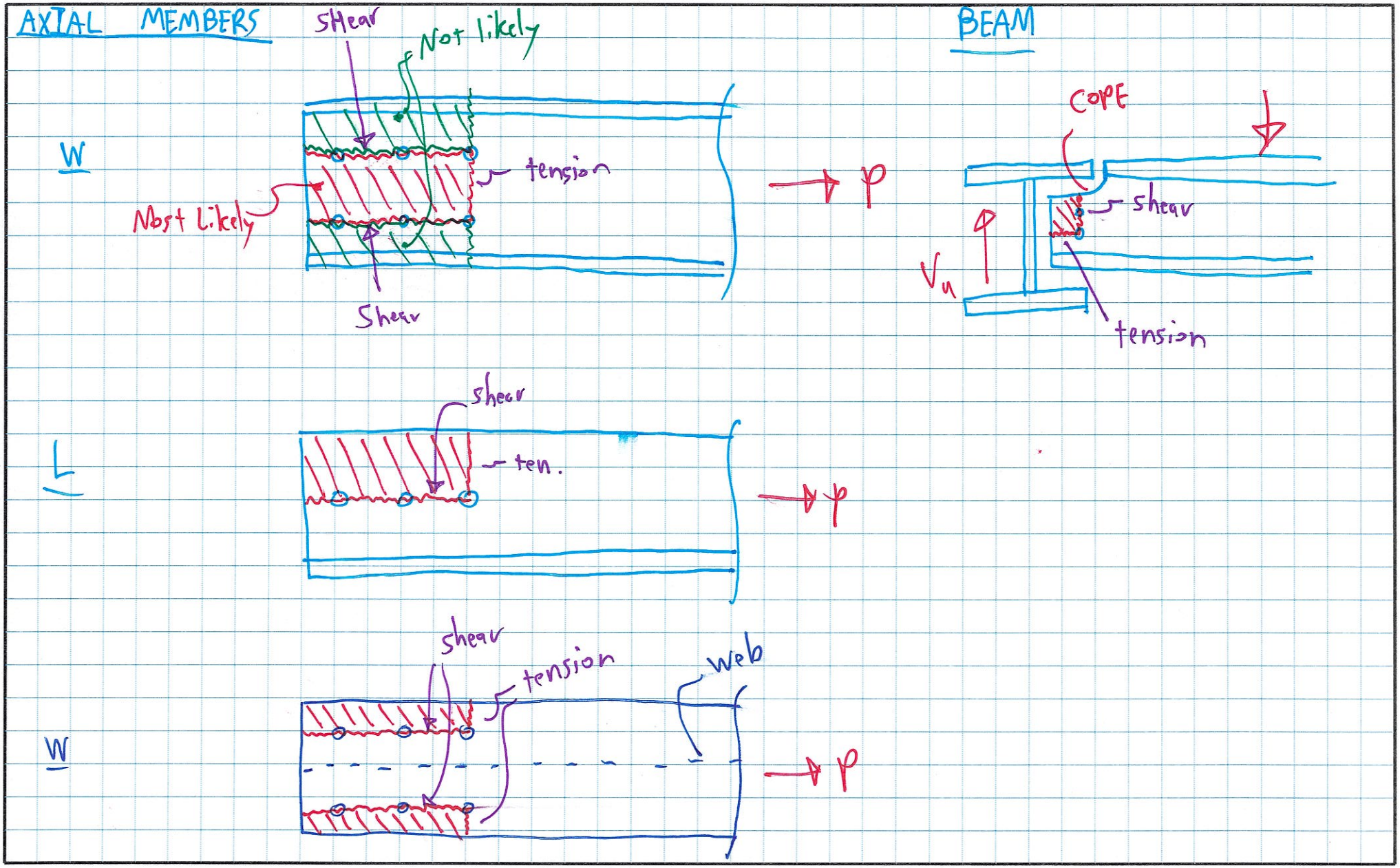
A_{nt} = net tension area

A_{gv} = gross shear area

U_{bs} = 1.0 for uniform shear
0.5 for non-uniform shear

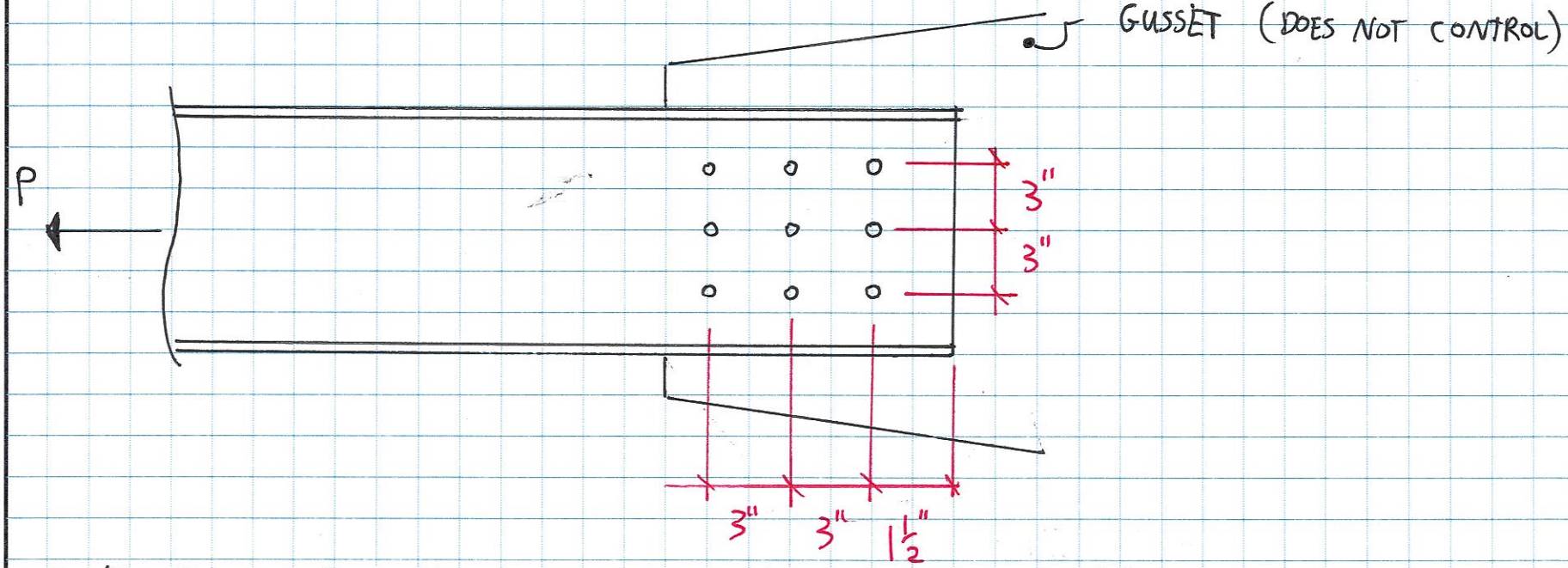
p16.1-444 & 445

CVEN 446 → 1.0



EXAMPLE

GIVEN: A SINGLE C12X30, A36 STEEL, CONNECTED TO A PL W/ 3/4" ϕ BOLTS
← Diam. Symbol



REQ'D: COMPUTE THE DESIGN TENSILE STRENGTH OF THE CHANNEL

SOLN: