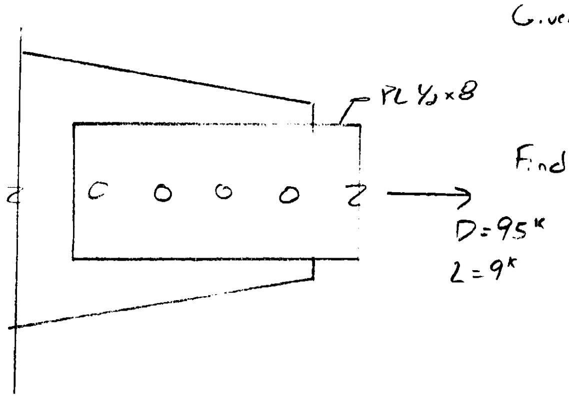


Given: PL ½×8 of A36 steel
$1\frac{1}{8}$" ϕ bolts
Assume $A_e = A_n$

Find: Is member adequate

1) Yield $\phi R_n = \phi F_y A_g$, $\phi = .9$ for yield
$A_g = (\frac{1}{2}")(8") = 4 in^2$
$F_y = 36 ksi$ Table 2-3 [2-39]

$\phi R_n = (.9)(36ksi)(4in^2) = \underline{129.6^k}$ ← * controls

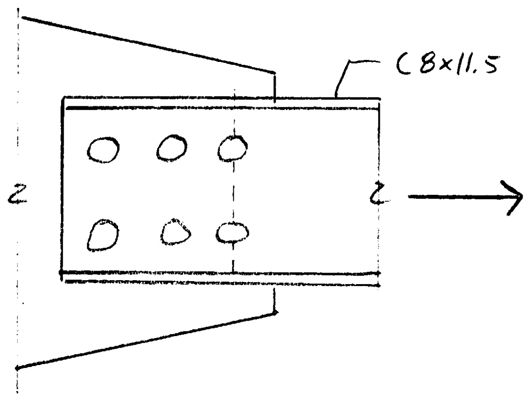
2.) Fracture $\phi R_n = \phi F_u A_e$, $\phi = .75$ for fracture
$F_u = 58 ksi$
$A_e = A_n$
A_n: $d_{hole} = d_{dia} + \frac{1}{8}" = 1\frac{1}{8}" + \frac{1}{8}" = 1\frac{1}{4}"$
$A_n = A_g - (\#_{holes})(d_{holes})(t_{PL})$
$A_n = 4in^2 - (1)(1\frac{1}{4}")(\frac{1}{2}") = 3.375 in^2$
$\therefore A_e = A_n = 3.375 in^2$

$\phi R_n = \phi F_u A_e$
$= (.75)(58ksi)(3.375in^2) = \underline{\underline{146.8^k}}$

The design strength is the smaller of the two $\phi R_n = 130^k$

3.) Loads:
$P_u = \begin{cases} 1.4D \\ 1.2D + 1.6L \end{cases} = \begin{matrix} 1.4(95^k) \\ 1.2(95^k) + 1.6(9^k) \end{matrix} = \begin{matrix} 133^k \\ 128 \end{matrix} \Rightarrow P_u = \underline{\underline{133^k}}$

$\phi R_n \overset{?}{\geq} P_u$
$130^k \overset{?}{\geq} 133^k$ $\underline{\underline{NO}}$ ⇒ $\boxed{\text{Member is not adequate}}$



$d_{bolt} = 7/8''$
A572 Gr 50
DL & LL only
$A_e = .85 A_n$

$LL/DL = 3$

1.) Yield: $\phi R_n = \phi F_y A_g$

$\phi = .90$
$F_y = 50ksi$
$A_g = 3.37 in^2$ Table 1-5

$\phi R_n = (.90)(50ksi)(3.37in^2) = \underline{\underline{152^k}}$

2) Fracture: $\phi R_n = \phi F_u \cdot A_e$

$\phi = .75$
$F_u = 65ksi$
$A_e = .85 A_n$

$A_n = A_g - (\#bolts)(d_{hole})(t_w)$, $t_w = .22 in$ Table 1-5

$d_{hole} = (7/8'') + (1/8) = 1''$

$A_n = 3.37in^2 - (2)(1'')(.22in) = 2.93in^2$

$A_e = .85(2.93in^2) = 2.49in^2$

$\phi R_n = (.75)(65ksi)(2.49in^2) = \underline{\underline{121^K}}$ ← ✱ Controls

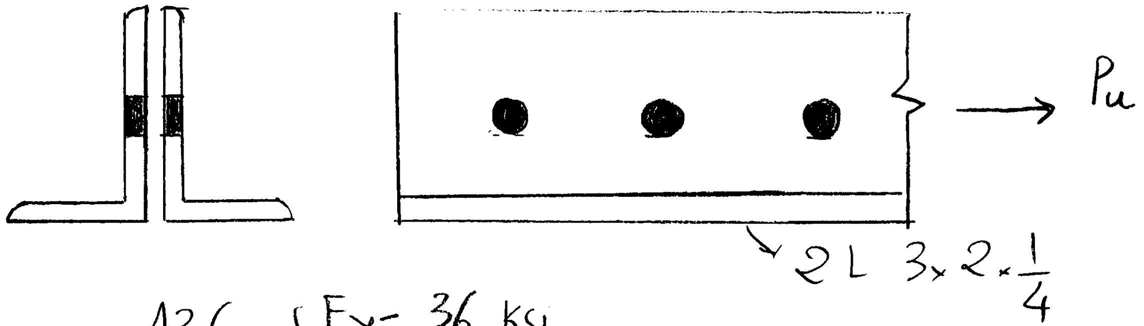
$\phi R_n = 121^K$

3. Service Loads: $\phi R_n \geq P_u$, $P_u = \begin{cases} 1.4D \\ 1.2D + 1.6L \end{cases} = \begin{matrix} 1.4D \\ 1.2D + 1.6(3D) \end{matrix} \begin{matrix} = 1.4D \\ = 6D \end{matrix}$ ← controls

$121.4^k \geq 6D \Rightarrow D = \underline{20.2^k}$

$\therefore L = 3D = \underline{60.7^K}$

$$\boxed{\begin{matrix} DL = 20.2^K \\ LL = 60.7^K \end{matrix}}$$



A36 $\begin{cases} F_y = 36 \text{ ksi} \\ F_u = 58 \text{ ksi} \end{cases}$

$\left.\begin{array}{l} DL = 12 \text{ kips} \\ LL = 36 \text{ kips} \end{array}\right\rangle$ $P_u = 1.2\,DL + 1.6\,LL$
$= 72 \text{ kips}$

2L $3 \times 2 \times 1/4 \rightarrow A_g = 2.40 \text{ in}^2$ (gross area)

Net area : $A_n - 2 \times \left(\frac{1}{4}''\right)\left(\frac{3}{4}'' + \frac{1}{8}''\right) = 1.96 \text{ in}^2$

Effective area : $A_e = 0.85\,A_n$
$= 1.67 \text{ in}^2$

Capacity based on yielding.

0.9 $\phi P_n = 0.9 \times A_g \times F_y = 77.8 \text{ kips}$

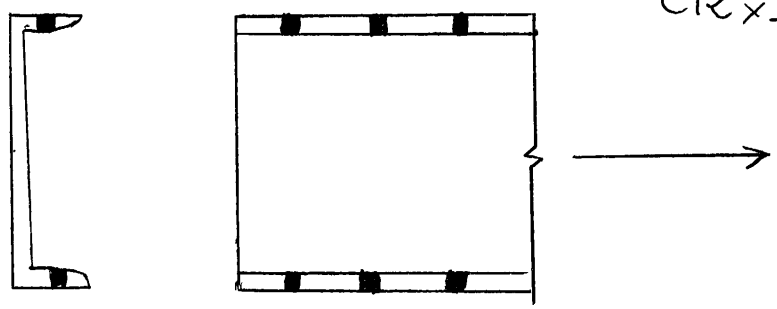
capacity based on rupture

$\phi P_n = 0.75 \times A_e \times F_u = 72.6 \text{ kips}$ → controls

Strength of member is $72.6 \text{ kips} > P_u = 72 \text{ kips}$

→ the section is adequate.

C12×30



$F_y = 50$ ksi $A_e = 0.9 A_n$

$F_u = 65$ ksi

Gross Area : $A_g = 8.81\ in^2$

Net Area : $A_n = 8.81\ in^2 - \left(\frac{1}{2}''\right)\left(1'' + \frac{1}{8}''\right) \times 2$

$= 7.685\ in^2$

Effective Area = $A_e = 0.9 \times 7.685\ in^2$

$= 6.917\ in^2$

Design strength based on yielding :

$\phi P_n = \phi . F_y \cdot A_g = 396.5$ Kips

ϕ: 0.9

Design strength based on fracture :

$\phi P_n = \phi\, F_u \cdot A_e = \boxed{337.2 \text{ kips}} \rightarrow \boxed{\text{controls}}$

ϕ: 0.75