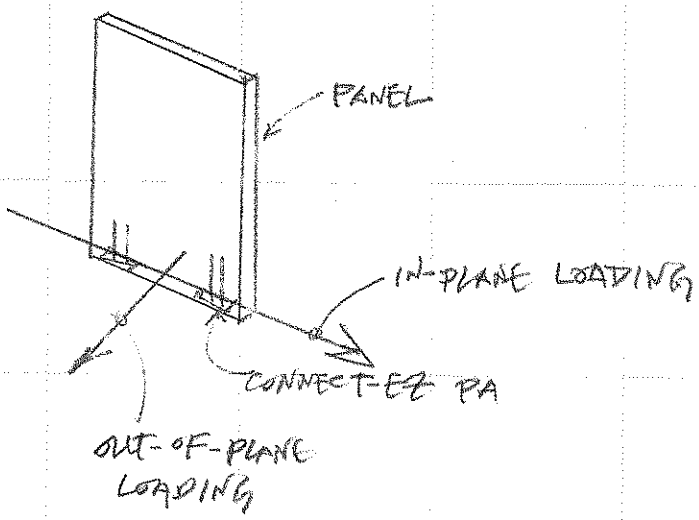
CROCKETT
ENGINEERING CONSULTANTS
2608 North Stadium Boulevard
Columbia, Missouri 65202
(573) 447-0292

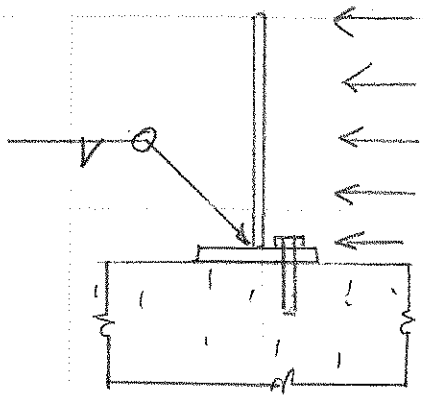
PROJECT NUMBER _____ SHEET ___ OF ___
PROJECT CONNECT-EZ ANCHOR
BY EWL DATE 2/9/12
SUBJECT _____

IN-PLANE & OUT-OF-PLANE CAPACITY (ASCE 7-05)



IN-PLANE & OUT-OF-PLANE SHOULD HAVE THE SAME CAPACITIES, SINCE THEY TRANSFER FORCE IN THE SAME ~~WAY~~ MANNER.

LOAD PATH



① PANEL CONCRETE BEARS ON DEFORMED BARS.
② BARS TRANSFER FORCE THROUGH WELDS TO PLATE.
③ PLATE BEARS ON TITEN HD.
④ TITEN HD BEARS ON CONCRETE IN FOUNDATION.

SAME TRUE FOR IN-PLANE FORCE.

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IN-PLANE & OUT-OF-PLANE CAPACITY (CONT'D)

① CHECK PANEL CONCRETE BEARING ON DEFORMED BARS

(ACI 318-08, 10.14)

FOR 1'-0" x #4 BAR: $\frac{1}{2}" \times 12" = 6\ in^2$

$$\phi R_n \geq R_u$$

$$\phi(0.85 f'_c A_1) \geq 1.6R$$

$$R \leq \frac{\phi(0.85 f'_c A_1)}{1.6}$$

$$\leq \frac{0.65(0.85(3500\ psi)(2 \times 6\ in^2)}{1.6}$$

ASSUMES WIND →

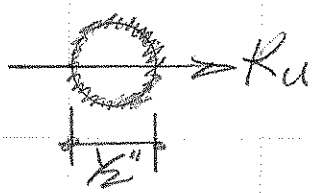
$$\leq 14{,}500\ \#$$ (UNFACTORED, PER EACH CONNECT-EZ PA)

(23,200 # EARTHQUAKE (E))

② CHECK WELDS OF BARS TO PLATE

ASSUME $\frac{1}{4}"$ FILLET WELDS, ALL-AROUND

$$\phi R_n \geq R_u$$



$$R_u = \frac{1.6R}{2(\pi(\frac{1}{2}"))} = \frac{1.6R}{\pi}$$

(UNFACTORED, PER EACH CONNECT-EZ)

$$\phi R_n = 0.75(0.6(70\ ksi)(0.707(\tfrac{1}{4}")))$$

$$= 5.57\ k/in$$

$$R \leq \frac{\pi(5.57\ k/in)}{1.6} = 10{,}900\ \#$$ ← USING

(17,400 # E)

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IN-PLANE & OUT-OF-PLANE CAPACITY (CONT'D)

(3) CHECK SHEAR OF BARS (AISC 13TH, J4.2)

a. SHEAR YIELDING ← 70 KSI DEFORMED BARS

$$\phi R_n \geq R_u$$

$$\phi(0.6 F_y A_g) \geq 1.6R$$

$$R \leq \frac{\phi(0.6 F_y A_g)}{1.6}$$

$$\leq \frac{1.0(0.6(70\,ksi)(2 \times 0.2\,in^2))}{1.6}$$

WIND →

$$\leq 10{,}500\,\#$$

$$(16{,}800\,\#\,E)$$

UNFACTORED, FOR ONE CONNECT-EZ PA

b. SHEAR RUPTURE

$$\phi R_n \geq R_u$$

$$\phi(0.6 F_u A_{nv}) \geq 1.6R$$

$$R \leq \frac{\phi(0.6 F_u A_{nv})}{1.6}$$

CONTROLS →

$$\leq \frac{0.75(0.6(90\,ksi)(2 \times 0.2\,in^2))}{1.6}$$

WIND →

$$\leq 10{,}100\,\#$$

$$(16{,}100\,\#\,E)$$

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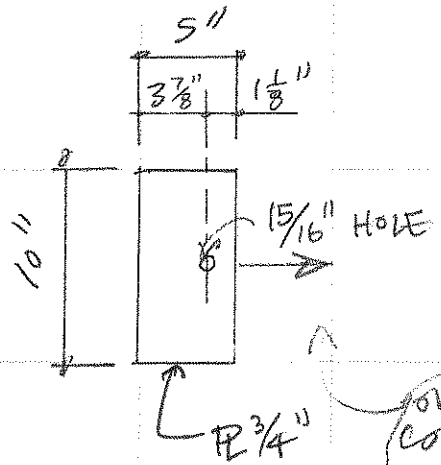
IN-PLANE & OUT-OF-PLANE CAPACITY (cont'd)

(4) CHECK PLATE

a. BEARING ON 3/4" ϕ BOLT (AISC 13TH, J3.10)

$\phi R_n \geq R_u$



→ DEFORMATION @ BOLT HOLE NOT A DESIGN CONSIDERATION

$R_n = 1.5 L_c t F_u \leq 3.0 d t F_u$

$= 1.5(0.66")(3/4")(58\ ksi)$

$= 23.5\ k \leq 3.0(3/4")(3/4")(58\ ksi)$

$\leq 98\ k$ OK

OUT-OF-PLANE CONTROLS

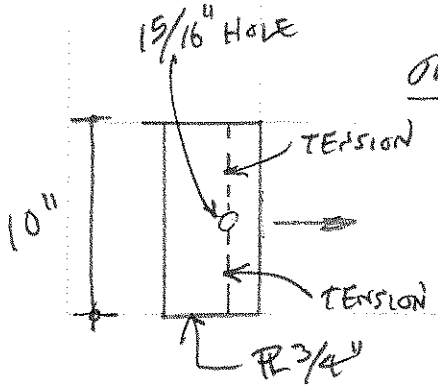
$0.75(23.5\ k) \geq 1.6R$

$R \leq \frac{0.75(23.5\ k)}{1.6}$

WIND → $\leq 11{,}000\ \#$ ← UNFACTORED PER EACH CONNECT-EZ

$(17{,}600\ \#_E)$

b. BLOCK SHEAR ON PLATE (AISC 13TH, J4.3)



OUT OF-PLANE

$R_n = 0.6 F_y A_{gv} + U_{bs} F_u A_{nt}$

$= N/A + 1.0(58\ ksi)(10" - 5/16")(0.75")$

$= 394{,}000\ \#$

WIND

$R \leq \frac{0.75(394{,}000\ \#)}{2}$ → $185{,}000\ \#$ $(296{,}000\ \#_E)$

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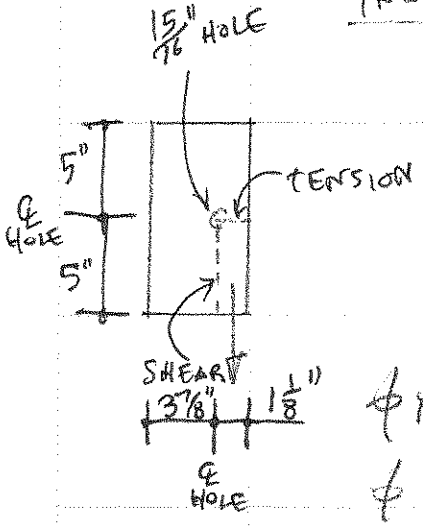
IN-PLANE & OUT-OF-PLANE CAPACITY (CONT'D)

(4) (CONT'D)

IN-PLANE



$R_n = 0.6 F_y A_{gv} + U_{bs} F_u A_{nt}$

$= 0.6(36\ ksi)(4.53" \times 0.75") + 1.0(58\ ksi)(0.66" \times 0.75")$

$= \underline{102{,}000\ \#}$ (163,000 # E)
↑ WIND

$\phi R_n \geq R_u$

$\phi R_n \geq 1.6R$

$R \leq \frac{\phi R_n}{1.6}$

$\leq \frac{0.75(102{,}000\ \#)}{1.6}$

$\leq \underline{47{,}800\ \#}$ ← UNFACTORED, PER EACH CONNECT-EZ
↑ WIND

(76,500 # E)

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IN-PLANE & OUT-OF-PLANE CAPACITY (CONT'D)

SUMMARY

IN-PLANE & OUT-OF-PLANE CAPACITIES ARE CONTROLLED BY SHEAR RUPTURE OF BARS.

2009 IBC/ ASCE 7-05 →

$W \leq 10{,}100$ #

$E \leq 16{,}100$ #

← ASSUMING 1.6 LOAD FACTOR IN STRENGTH DESIGN

NOTE: FOR 2012 IBC/ ASCE 7-10, WIND CHANGES TO STRENGTH LEVEL.

∴ FOR STRENGTH DESIGN,

$W \leq 16{,}100$ #

$E \leq 16{,}100$ #

FOR ALLOWABLE STRENGTH DESIGN

$0.6W \leq 9660$ #

$0.7E \leq 11{,}300$ #