Example A2—Single stud, shear only

Design an embedment using a stud welded to an embedded plate.

(handwritten: ACI 349.   D.6-)

(handwritten box: Ø stud = 0.625"   h$_{eff, stud}$ = 4")

(handwritten: OXapp-anchor-East-Wall.py ; Vua = 1'6 × 5'3 kip)

Given:

Edges

$c_{a1} = 10$ in. ✓

$c_{a2} = 18$ in. ✓

$h_a = 18$ in. ✓

Concrete *(handwritten: concrete.)*

$f'_c = 4000$ psi ✓ *(handwritten: steel -)*

Stud material (A29/A108)[*] ✓ *(handwritten: → steel.fyk.)*

$f_{ya} = 51$ ksi *(handwritten: = 351 MPa yield.)*

$f_{uta} = 65$ ksi *(handwritten: = 448 MPa → specified tensile strength of anchor)*

(handwritten: → steel.fmaxk( ) steel)

Plate

Assume 3 x 3 x 3/8 in. thick

$F_y = 36$ ksi

Loads

$V_{ua} = 6$ kips ✓
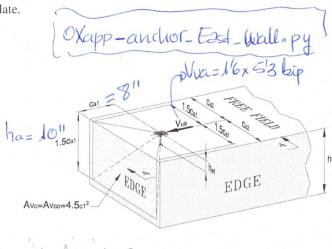
Where V_{ua} is the applied factored external load using load factors from Appendix C of the Code.
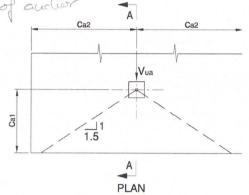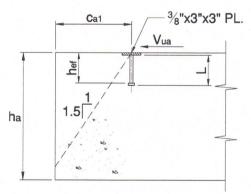
Assumptions:

- Concrete is cracked.
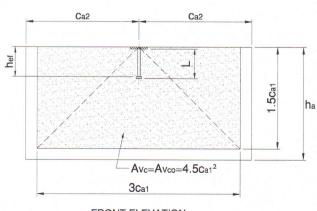- φ-factors are based on Condition B in D.4.5 of the Code (no supplementary reinforcement).

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[*]Stud material is A29/A108, material properties per AWS D1.1, 2006, Table 7.1, Type B stud. Yield strength = 51 ksi; tensile strength = 65 ksi. It has elongation of 20% and reduction in area of 50%; meets the definition of a ductile steel element given in D.1. and meets the tensile strength requirements of D.5.1.2 and D.6.1.2: $f_{uta} \leq 1.9f_{ya}$ (65 ≤ 1.9 × 51 = 96.9 < 125 ksi).

(handwritten: diam. ; h ef. ; cast_in.)

(handwritten figure labels for isometric view: $c_{a1} = 8"$, $1.5c_{a1}$, $h_a = 10"$, $1.5c_{a1}$, $1.5c_{a2}$, $1.5c_{a1}$, FREE FIELD, Vua, h$_{ef}$, h_a, EDGE, EDGE, $A_{VC} = A_{VCO} = 4.5c_1^2$)

PLAN

(labels: c_{a2}, c_{a2}, A, c_{a1}, Vua, 1.5 / 1, A)

SECTION A-A

(labels: c_{a1}, 3/8"x3"x3" PL., Vua, h$_{ef}$, L, 1.5 / 1, ha)

FRONT ELEVATION

(labels: c_{a2}, c_{a2}, h$_{ef}$, L, $1.5c_{a1}$, ha, $A_{VC} = A_{VCO} = 4.5c_{a1}^2$, $3c_{a1}$)

(handwritten side notes: 4/3 (au2) = 4/3 (au2u . a2u . au2u); 4/3 (au2) = 4/3(au2u.a2u.au2); " ; 4/3)