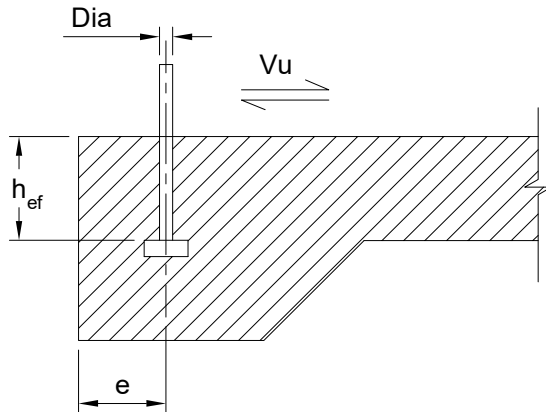




Design a Single Headed Anchor Bolt in Shear Near an Edge as per ACI 318-11 Appendix D



System

Edge Distance, $e =$ 1.75 in

Load

Ultimate Load, $V_u =$ 700 lb

Material Properties

Concrete Strength, $f'_c =$ 4000 psi

Tensile Strength of Anchor Bolt Grade, $f_{uta} =$ 58000 psi

Strength Reduction Factor (According to Cl.D.4.4.a of ACI318), $\Phi_1 =$ 0.65

Strength Reduction Factor (According to Cl.D.4.4.c of ACI318), $\Phi_2 =$ 0.70

Modification Factor for Lightweight Concrete, $\lambda =$ 1.00

Determine Anchor Diameter

Required Effective Area of Anchor Bolt (According to Eq.D.29 of ACI318),

$$A_{se_Req} = \frac{V_u}{\Phi_1 * 1.0 * 0.6 * f_{uta}} = 0.031 \text{ in}^2$$

Provided Anchor Bolt, Dia = SEL("ACI/Anchor"; Dia;) = 0.500 in

Provided Area of Anchor Bolt, $A_{se_Prov} =$ TAB("ACI/Anchor"; Ase; Dia=Dia) = 0.142 in²

Check Validity = IF($A_{se_Prov} \geq A_{se_Req}$; "Valid"; "Increase Dia") = Valid

Calculation of Embedment Strength

Assume that, $h_{ef_Prov} =$ 7.00 in

Ratio A_{vc}/A_{vco} , $A' =$ 1.00

Factor (According to Cl.D.6 of ACI318), $\psi_{ed,V} =$ 1.00

Factor (According to Cl.D.6.2.7 of ACI318), $\psi_{c,V} =$ 1.00

Length of Load Bearing of Anchor Bolt (According to Cl.D.6.2.2 of ACI318),

$$l_e = \text{MIN}(h_{ef_Prov}; 8 * \text{Dia};) = 4.00 \text{ in}$$

Basic Strength of Concrete Breakout (According to Eq.D-33 of ACI318),



$$V_{b1} = 7 \left(\frac{l_e}{Dia} \right)^{0.2} * \sqrt{Dia} * \lambda * \sqrt{f'_c} * e^{1.5} = 1098 \text{ lb}$$

Basic Strength of Concrete Breakout (According to Eq.D-34 of ACI318),

$$V_{b2} = 9 * \lambda * \sqrt{f'_c} * e^{1.5} = 1318 \text{ lb}$$

$$\text{Basic Strength of Concrete Breakout, } V_b = \text{MIN}(V_{b1}; V_{b2}) = 1098 \text{ lb}$$

Nominal Strength of Concrete Breakout (According to Eq.D-30 of ACI318),

$$\Phi V_{cb} = A' * \Phi_2 * \psi_{ed,V} * \psi_{c,V} * V_b = 769 \text{ lb}$$

$$\text{Check Validation} = \text{IF}(V_u \leq \Phi V_{cb}; \text{"Valid"}; \text{"Invalid"}) = \text{Valid}$$

Design Summary

$$\text{Diameter of Anchor Bolt, Dia} = Dia = 0.500 \text{ in}$$

$$\text{Embedment Length of Anchor Bolt, } h_{ef} = h_{ef_Prov} = 7.00 \text{ in}$$