APPENDIX C: Performance values in accordance to 2006 IBC

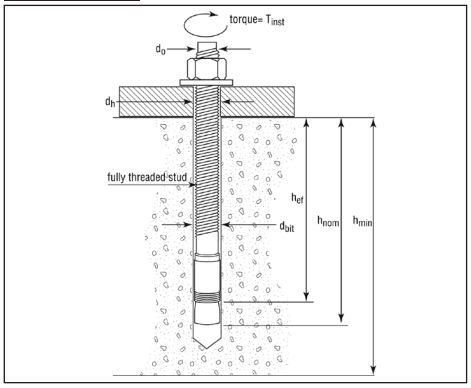
TRUBOLT+ WEDGE ANCHOR DESIGN INFORMATION

Trubolt+ Seismic Wedge Anchors

Characteristic	Symbol	Units	Nominal Anchor Diameter inch (mm)					
			1/2"				5/8"	
Installation Information								
Effective embedment depth	h_{ef}	in (mm)	2		3-1/4		2-3/4	4-1/4
Minimum slab thickness	h_{min}	in (mm)	4 (102)	6 (152)	6 (152)	8 (203)	6 (152)	8 (203)
Critcial edge distance	c_{ac}	in (mm)	6 (152)	6 (152)	7-1/2 (190)	6 (152)	6-3/4 (171)	7-1/2 (190)
Minimum edge distance	c_{min}	in (mm)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)	5 (127)
Minimum anchor spacing	s_{min}	in (mm)	6 (152)	5-3/4 (146)	4 (102)	5-3/4 (146)	7-1/2 (190)	6 (152)
Anchor Data								
Anchor category	1, 2 or 3	—	1					
Minimum specified yield strength	f_y	lb/in^2 (N/mm^2)	55,000 (379)					
Minimum specified ultimate strength	f_{uta}	lb/in^2 (N/mm^2)	75,000 (517)					
Effective tensile stress area	A_{se}	in^2 (mm^2)	0.142 (91.5)				0.226 (145.6)	
Shear strength	V_s	lb (kN)	5,175 (23.02)				9,490 (42.2)	
Effectiveness factor for uncracked concrete	k_{uncr}	—	24					
Effectiveness factor for cracked concrete	k_{cr}	—	17					
k_{uncr}/ k_{cr}	—	—	1.41					
Pullout strength, uncracked concrete	$N_{p,uncr}$	lb (kN)	k=24		6,540 (29.1)		5,430 (24.2)	8,905 (40.0)
Tension resistance of single anchor for seismic loads	$N_{p,eq}$	lb (kN)	k=17		k=17		k=17	6,720 (29.9)
Shear resistance of single anchor for seismic loads	V_{seis}	lb (kN)	5,175 (23.02)				9,490 (42.2)	
Strength reduction factor ϕ for tension, steel failure modes			0.75					
Strength reduction factor ϕ for shear, steel failure modes			0.65					
Strength reduction factor ϕ for tension, concrete failure modes, Condition B			0.65					
Strength reduction factor ϕ for shear, concrete failure modes, Condition B			0.70					

For SI: 1 inch =25.4 mm, 1 lbf = 4.45 N, 1 psi = 0.006895 MPa, For pound-inch units: 1 mm = 0.03937 inches
All anchors are classified as ductile in accordance with D1 of ACI 318.

TRUBOLT+ WEDGE ANCHOR (INSTALLED)



TRUBOLT+ WEDGE INSTALLATION INFORMATION

	Symbol	Units						
Anchor outer diameter	d_o	in (mm)	1/2 (12.7)				5/8 (15.9)	
Nominal carbide bit diameter	d_{bit}	in (mm)	1/2 (12.7)				5/8 (15.9)	
Effective embedment depth	h_{ef}	in (mm)	2 (51)		3-1/4 (83)		2-3/4 (70)	4-1/4 (108)
Anchor embedment depth	h_{nom}	in (mm)	2-1/2 (64)		3-3/4 (95)		3-1/4 (83)	4-3/4 (121)
Minimum slab thickness	h_{min}	in (mm)	4 (102)	6 (152)	6 (152)	8 (203)	6 (152)	8 (203)
Installation torque	T_{inst}	ft-lb (N-m)	45 (61)				90 (121)	
Reference hole diameter	d_h	in (mm)	9/16 (14)				11/16 (17)	

TRUBOLT+ WEDGE ANCHOR ALLOWABLE STATIC TENSION (ASD), NORMAL-WEIGHT UNCRACKED CONCRETE (POUNDS)[1-5]

Nominal Anchor Diameter (in.)	Effective Embedment Depth (in.)	Concrete Compressive Strength		
		f'c = 2,500 psi	f'c = 3,000 psi	f'c = 4,000 psi
1/2	2	1,490	1,630	1,885
	3-1/4	2,870	3,145	3,635
5/8	2-3/4	2,385	2,610	3,015
	4-1/4	3,910	4,285	4,945

For SI: 1 inch = 25.4 mm, 1 lbf = 4.45 N, 1 psi = 0.006895 Mpa
Design Assumptions:

1 Single anchor with static tension load only.
2 Load combinations from 2006 IBC, Sections 1605.2.1 and 1605.3.1 (no seismic loading).
3 Assumed thirty percent dead load and 70 percent live load, controlling load combination 1.2D + 1.6L
4 Calculation of weighted average: 1.2D + 1.6L = 1.2 (0.3) + 1.6 (0.7) = 1.48
5 Values do not include edge distance or spacing reductions.

APPENDIX C: Performance values in accordance to 2006 IBC

TRUBOLT+ WEDGE ANCHOR ALLOWABLE STATIC TENSION (ASD), NORMAL-WEIGHT CRACKED CONCRETE (POUNDS) [1-5]

Nominal Anchor Diameter (in.)	Effective Embedment Depth (in.)	Concrete Compressive Strength		
		f'c = 2,500 psi	f'c = 3,000 psi	f'c = 4,000 psi
1/2	2	1,055	1,155	1,335
	3-1/4	2,190	2,395	2,765
5/8	2-3/4	1,700	1,865	2,155
	4-1/4	2,950	3,235	3,735

TRUBOLT+ WEDGE ANCHOR ALLOWABLE STATIC SHEAR (ASD), STEEL (POUNDS)[1-6]

Nominal Anchor Diameter (in.)	Allowable Steel Capacity, Static Shear
1/2	2,445
5/8	4,490

For SI: 1 inch = 25.4 mm, 1 lbf = 4.45 N, 1 psi = 0.006895 Mpa
Design Assumptions:

1 Single anchor with static tension or shear load only.
2 Load combinations from 2006 IBC, Sections 1605.2.1 and 1605.3.1 (no seismic loading).
3 Assumed thirty percent dead load and 70 percent live load, controlling load combination 1.2D + 1.6L
4 Calculation of weighted average: 1.2D + 1.6L = 1.2 (0.3) + 1.6 (0.7) = 1.48
5 Values do not include edge distance or spacing reductions.
6 Static shear values pertain to cracked and uncracked concrete.

TRUBOLT+ WEDGE ANCHOR ALLOWABLE SEISMIC TENSION (ASD), NORMAL-WEIGHT CRACKED CONCRETE (POUNDS) [1-5]

Nominal Anchor Diameter (in.)	Effective Embedment Depth (in.)	Concrete Compressive Strength		
		f'c = 2,500 psi	f'c = 3,000 psi	f'c = 4,000 psi
1/2	2	905	990	1,145
	3-1/4	1,880	2,055	2,370
5/8	2-3/4	1,460	1,600	1,850
	4-1/4	2,530	2,775	4,145

TRUBOLT+ WEDGE ANCHOR ALLOWABLE SEISMIC SHEAR (ASD), STEEL (POUNDS)[1-5]

Nominal Anchor Diameter (in.)	Allowable Steel Capacity, Seismic Shear
1/2	2,095
5/8	3,850

For SI: 1 inch = 25.4 mm, 1 lbf = 4.45 N, 1 psi = 0.006895 Mpa
Design Assumptions:

1 Single anchor with seismic tension or shear load only.
2 Load combinations from 2006 IBC, Sections 1605.2.1 and 1605.3.1
3 Assumed 50% dead load and 50% seismic (earthquake) load, controlling load combinations: Strength Design = 1.2D + 1.0E and Allowable Stress Design = 1.0D + 0.7E (see Illustrative Procedure)
4 Values include 0.75 factor for regions of moderate to high seismic risk (per ACI 318 D.3.3.3)
5 Values do not include edge distance or spacing reductions.

ILLUSTRATIVE PROCEDURE TO CALCULATE ALLOWABLE STRESS DESIGN SEISMIC TENSION VALUE: RED HEAD TRUBOLT+ WEDGE ANCHOR 1/2 INCH DIAMETER USING AN EFFECTIVE EMBEDMENT OF 3-1/4 INCHES

STEPS	PROCEDURE	CALCULATION
Step 1	Calculate steel strength in tension per ACI 318 D5.1.2	$= \phi f_{uta} A_{se}$ $= 0.75 * 75{,}000 * 0.142 =$ **7,988 lbs**
Step 2	Calculate concrete breakout strength in tension Per ACI 318 D5.2.2	$= \phi \kappa_{uncr}$ sqrt (concrete strength) $h_{ef}^{1.5}$ $= 0.65 * 17 *$ sqrt(2,500) $* 3.25^{1.5} =$ **3,240 lbs**
Step 3	Calculate pullout strength in tension per ACI D5.3.2	Does not control
Step 4	Calculate controlling strength in tension per ACI D4.1.2 Multiple strength by 0.75 (per ACI 318 D.3.3.3) for regions of moderate to high seismic risk	= 3,240 lbs (concrete strength) $= 3{,}240 * 0.75 =$ **2,430 lbs**
Step 5	Calculate conversion factor to convert from Strength Design to Allowable Stress Design • Assume 50% dead load and 50% seismic (earthquake) load	For Strength Design = 1.2D + 1.0E $= 1.2 * 0.5 + 1.0 * 0.5 = 1.1$ For Allowable Stress Design = 1.0D + 0.7E $= 1.0 * 0.5 + 0.7 * 0.5 = 0.85$ Conversion factor = 1.1/0.85 = **1.294**
Step 6	Divide controlling strength by conversion factor	= 2,430 lbs/1.294 = **1,880 lbs**