Building and Safety Division - Public Information

County of Ventura • Resource Management Agency • http://www.ventura.org/rma/build_safe
Main Office • 800 S. Victoria Ave, Ventura, CA. 93009 • 805-654-2771
East County Office • 3855-F Alamo St., 2nd Fl. # 2019A, Simi Valley, CA 93065 • 805-582-8064

ALLOWABLE TENSION AND SHEAR LOADS FOR EPOXY TYPE ANCHORS

CODES: International Code Council's Research Reports and International Code Council's AC308 and CBC section 1908.1.16

SPECIFICATIONS:

1. The anchors must be installed in concrete having a specified compressive strength of fc'= 2500 psi to 8000 psi.
2. The anchor bolt material shall be ASTM A307 Gr.B threaded rod or better.
3. The tabulated values are based on the following epoxy bond strengths:

   For db = ½", $\tau_{k,cr}$ = 1040 psi $\tau_{k,uncr}$ = 2422 psi For db = ¾", $\tau_{k,cr}$ = 1000 psi $\tau_{k,uncr}$ = 2065 psi

   For db = ⅝", $\tau_{k,cr}$ = 718 psi $\tau_{k,uncr}$ = 2263 psi For db = ⅞", $\tau_{k,cr}$ = 495 psi $\tau_{k,uncr}$ = 1670 psi

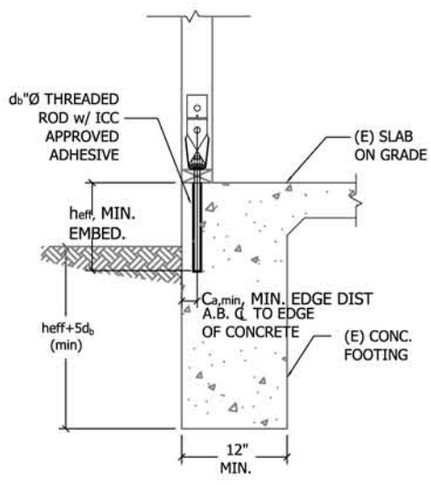
4. The tabulated values are based on the following equations from ICC AC308:
   1. Steel Strength of anchor in tension: $\emptyset N_{sa} = \emptyset\ n\ A_{se} f_{uta}$, $\emptyset = 0.65$
   2. Steel Strength of anchor in shear: $\emptyset V_{sa} = \emptyset\ n\ A_{se} f_{uta}$, $\emptyset = 0.65$
   3. Concrete breakout strength of anchor in tension: $\emptyset N_{cb} = \emptyset \frac{A_{Nc}}{A_{Nco}} \Psi_{ed,N} \Psi_{c,N} \Psi_{cp,N} N_b$, $\emptyset = 0.65$
   4. Concrete breakout strength of anchor in shear: $\emptyset V_{cb} = \emptyset \frac{A_{Vc}}{A_{Vco}} \Psi_{ed,V} \Psi_{c,V} V_b$, $\emptyset = 0.70$
   5. Pullout strength of anchor in tension: $\emptyset N_a = \emptyset \frac{A_{Na}}{A_{Nao}} \Psi_{ed,Na} \Psi_{p,Na} N_a$, $\emptyset = 0.65$
   6. Concrete pryout strength of anchor in shear: $\emptyset V_{cp} = \emptyset \times \min[k_{cp} N_a, k_{cp} N_{cb}]$, $\emptyset = 0.70$

CONDITIONS OF USE:

1. Adhesives shall have a current ICC report for use in cracked concrete.
2. Special Inspection is required during the installation of epoxy anchors.
3. The tabulated loads may not be increased.
4. End distance of anchors shall be a minimum of 1.5 x heff.
5. Structural calculations in accordance with a current ICC report shall be submitted if values not tabulated below are desired.
6. Epoxy anchors are permitted in interior and exterior use with no regular exposure to moisture.
7. Preservative treated wood formulations are corrosive and must be verified with the wood supplier.
8. Outdoor environments are generally more corrosive to steel, consult with the anchor manufacturer regarding corrosion protection.
9. Values are applicable to locations with the following temperature range: Max Short Term Temp = 110° Fahrenheit, Max. Long Term Temp = 75° Fahrenheit.
10. Tabulated values have been calculated by dividing the calculated strength of the anchor by α = 1.4.
11. Anchors shall not be spaced less than 16" apart.

Notations:

- d_b = Anchor bolt diameter, in.
- $\tau_{k,cr}$ = Characteristic bond strength of adhesive at Temperature Range 1 for cracked concrete, psi.
- $\tau_{k,uncr}$ = Characteristic bond strength of adhesive at Temperature Range 1 for uncracked concrete, psi.
- A_{se} = Minimum tensile stress area of steel anchor bolt, in.^{2}
- f_{uta} = Specified tensile strength of anchor steel, psi
- A_{Nc} = Projected concrete area of a single anchor, for calculation of strength in tension, in.^{2}
- A_{Nco} = Projected concrete failure area of a single anchor, for calculation of strength in tension if not limited by edge distance or spacing, in.^{2}
- A_{Vc} = Projected concrete failure area of a single anchor for calculation of strength in shear, in.^{2}
- A_{Vco} = Projected concrete failure area of a single anchor, for calculation of strength in shear if not limited by corner influences, spacing, or member thickness, in.^{2}
- A_{Na0} = Projected area of the failure surface of a single anchor without the influence of proximate edges, in.^{2}
- A_{Na} = Projected area of the failure surface for the anchor that must be approximated as the base of the rectilinear geometrical figure that results from projecting the failure surface outward a distance $C_{cr,Na}$ from the centerlines of the anchor, in.^{2}
- $\Psi_{ed,N}$ = Factor used to modify tensile strength of anchors based on eccentricity of applied loads
- $\Psi_{c,N}$ = Factor used to modify tensile strength of anchors based on presence or absence of cracks in concrete
- $\Psi_{cp,N}$ = Factor used to modify tensile strength of post-installed anchors intended for use in uncracked concrete without supplementary reinforcement
- $\Psi_{ed,V}$ = Factor used to modify shear strength of anchors based on proximity to edges of concrete member
- $\Psi_{c,V}$ = Factor used to modify shear strength of anchors based presence or absence of cracks in concrete and presence or absence of supplementary reinforcement
- $\Psi_{ed,Na}$ = Factor used to modify tensile strength of adhesive anchors based on proximity to edges of concrete member
- $\Psi_{p,Na}$ = Factor used to modify tensile strength of adhesive anchors based on the absence of concrete cracking at service load levels
- k_{cp} = coefficient for pryout strength



(E) SLAB ON GRADE

Allowable Tension and Shear Loads for Slab on Grade Foundations in lbs (Based on ASD method)

d_b, Bolt Dia, in.	h_{eff}, Min. embed. depth, in.	$C_{a,min}$, Edge Distance, in.	Tension	Shear	d_b, Bolt Dia, in.	h_{eff}, Min. embed. depth, in.	$C_{a,min}$, Edge Distance, in.	Tension	Shear
½"	4"	1¾"	462	260	¾"	6"	1¾"	788	319
		2¾"	555	513			2¾"	899	628
	5"	1¾"	565	260		8"	1¾"	1141	319
		2¾"	671	513			2¾"	1266	628
	6"	1¾"	678	260		10"	1¾"	1488	319
		2¾"	805	513			2¾"	1673	628
	8"	1¾"	904	260		12"	1¾"	1786	319
		2¾"	1074	513			2¾"	2039	628
	10"	1¾"	1129	260		14"	1¾"	2084	319
		2¾"	1146	513			2¾"	2379	628
	12"	1¾"	1146	260		15"	1¾"	2232	319
		2¾"	1146	513			2¾"	2549	628
⅝"	5"	1¾"	466	291	⅞"	7"	1¾"	595	344
		2¾"	543	574			2¾"	676	679
	6"	1¾"	553	291		8"	1¾"	680	344
		2¾"	642	574			2¾"	773	679
	8"	1¾"	738	291		10"	1¾"	850	344
		2¾"	856	574			2¾"	966	679
	9"	1¾"	830	291		13"	1¾"	1105	344
		2¾"	963	574			2¾"	1255	679
	10"	1¾"	922	291		15"	1¾"	1275	344
		2¾"	1070	574			2¾"	1449	679
	12"	1¾"	1107	291		17½"	1¾"	1488	344
		2¾"	1283	574			2¾"	1690	679

DIVISION OF BUILDING AND SAFETY
COUNTY OF VENTURA
BUILDING OFFICIAL
Jim MacDonald, C.B.O.

B & S STD **B-92** Sheet 1 of 2

Effective: January 1, 2009

Building and Safety Division - Public Information

County of Ventura • Resource Management Agency • http://www.ventura.org/rma/build_safe
Main Office • 800 S. Victoria Ave, Ventura, CA. 93009 • 805-654-2771
East County Office • 3855-F Alamo St., 2nd Fl. # 2019A, Simi Valley, CA 93065 • 805-582-8064

ALLOWABLE TENSION AND SHEAR LOADS FOR EPOXY TYPE ANCHORS

CODES: 2007 California Building Code, 2007 Ventura County Building code, AC308 and CBC section 1908.1.16

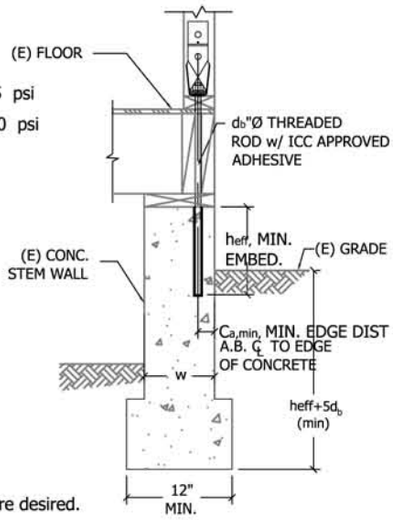
SPECIFICATIONS:

1. The anchors must be installed in concrete having a specified compressive strength of fc'= 2500 psi to 8000 psi.
2. The anchor bolt material shall be ASTM A307 Gr.B threaded rod or better.
3. The tabulated values are based on the following epoxy bond strengths:

   For $d_b = \frac{1}{2}$", $\tau_{c,cr}$ = 1040 psi $\tau_{c,uncr}$ = 2422 psi For $d_b = \frac{3}{4}$", $\tau_{c,cr}$ = 1000 psi $\tau_{c,uncr}$ = 2065 psi

   For $d_b = \frac{5}{8}$", $\tau_{c,cr}$ = 718 psi $\tau_{c,uncr}$ = 2263 psi For $d_b = \frac{7}{8}$", $\tau_{c,cr}$ = 495 psi $\tau_{c,uncr}$ = 1670 psi

4. The tabulated values are based on the following equations from ICC AC308:
   1. Steel Strength of anchor in tension: $\emptyset N_{sa} = \emptyset\ n\ A_{se} f_{uta}$, $\emptyset$ = 0.65
   2. Steel Strength of anchor in shear: $\emptyset V_{sa} = \emptyset\ n\ A_{se} f_{uta}$, $\emptyset$ = 0.65
   3. Concrete breakout strength of anchor in tension: $\emptyset N_{cb} = \emptyset \frac{A_{Nc}}{A_{Nco}} \psi_{ed,N} \psi_{c,N}\ \psi_{cp,N} N_b$, $\emptyset$ = 0.65
   4. Concrete breakout strength of anchor in shear: $\emptyset V_{cb} = \emptyset \frac{A_{Vco}}{A_{Vc}} \psi_{ed,V} \psi_{c,V}\ V_b$, $\emptyset$ = 0.70
   5. Pullout strength of anchor in tension: $\emptyset N_a = \emptyset \frac{A_{Na}}{A_{Nao}} \psi_{ed,Na} \psi_{p,Na} N_a$, $\emptyset$ = 0.65
   6. Concrete pryout strength of anchor in shear: $\emptyset V_{cp} = \emptyset$ x min[$k_{cp} N_a$, $k_{cp} N_{cb}$], $\emptyset$ = 0.70



(E) RAISED FLOOR FOOTING

CONDITIONS OF USE:

1. Adhesives shall have a current ICC report for use in cracked concrete per 2006 IBC.
2. Special Inspection is required during the installation of epoxy anchors.
3. The tabulated loads may not be increased.
4. End distance of anchors shall be a minimum of 1.5 x heff.
5. Structural calculations in accordance with a current ICC report shall be submitted if values not tabulated below are desired.
6. Epoxy anchors are permitted in interior and exterior use with no regular exposure to moisture.
7. Preservative treated wood formulations are corrosive and must be verified with the wood supplier.
8. Outdoor environments are generally more corrosive to steel, consult with the anchor manufacturer regarding corrosion protection.
9. Values are applicable to locations with the following temperature range: Max. Short Term Temp. = 110° Fahrenheit, Max. Long Term Temp. = 75° Fahrenheit.
10. Tabulated values have been calculated by dividing the calculated strength of the anchor by α = 1.4
11. Anchors shall not be spaced less than 16" apart.

Notations:

- d_b = Anchor bolt diameter, in.
- $\tau_{c,cr}$ = Characteristic bond strength of adhesive at Temperature Range 1 for cracked concrete, psi.
- $\tau_{c,uncr}$ = Characteristic bond strength of adhesive at Temperature Range 1 for uncracked concrete, psi.
- A_{se} = Minimum tensile stress area of steel anchor bolt, in.^{2}
- f_{uta} = Specified tensile strength of anchor steel, psi
- A_{Nc} = Projected concrete area of a single anchor, for calculation of strength in tension, in.^{2}
- A_{Nco} = Projected concrete failure area of a single anchor, for calculation of strength in tension if not limited by edge distance or spacing, in.^{2}
- A_{Vc} = Projected concrete failure area of a single anchor for calculation of strength in shear, in.^{2}
- A_{Vco} = Projected concrete failure area of a single anchor, for calculation of strength in shear if not limited by corner influences, spacing, or member thickness, in.^{2}
- A_{Na0} = Projected area of the failure surface of a single anchor without the influence of proximate edges, in.^{2}
- A_{Na} = Projected area of the failure surface for the anchor that must be approximated as the base of the rectilinear geometrical figure that results from projecting the failure surface outward a distance $C_{cr,Na}$ from the centerlines of the anchor, in.^{2}
- $\psi_{ed,N}$ = Factor used to modify tensile strength of anchors based on eccentricity of applied loads
- $\psi_{c,N}$ = Factor used to modify tensile strength of anchors based on presence or absence of cracks in concrete
- $\psi_{cp,N}$ = Factor used to modify tensile strength of post-installed anchors intended for use in uncracked concrete without supplementary reinforcement
- $\psi_{ed,V}$ = Factor used to modify shear strength of anchors based on proximity to edges of concrete member
- $\psi_{c,V}$ = Factor used to modify shear strength of anchors based presence or absence of cracks in concrete and presence or absence of supplementary reinforcement
- $\psi_{ed,Na}$ = Factor used to modify tensile strength of adhesive anchors based on proximity to edges of concrete member
- $\psi_{p,Na}$ = Factor used to modify tensile strength of adhesive anchors based on the absence of concrete cracking at service load levels
- k_{cp} = coefficient for pryout strength

Allowable Tension and Shear Loads for Raised Floor Condition in lbs (Based on ASD method)

Stem width, w, in.	Embed. depth, h_{eff}, in.	Bolt Diameter (d_b) = ½"				Bolt Diameter (d_b) = ⅝"				Bolt Diameter (d_b) = ¾"				Bolt Diameter (d_b) = ⅞"			
		Edge Dist ($C_{a,min}$), in.				Edge Dist ($C_{a,min}$), in.				Edge Dist ($C_{a,min}$), in.				Edge Dist ($C_{a,min}$), in.			
		1¾"		2¾"		1¾"		2¾"		1¾"		2¾"		1¾"		2¾"	
		Tension	Shear	Tension	Shear	Tension	Shear	Tension	Shear	Tension	Shear	Tension	Shear	Tension	Shear	Tension	Shear
6"	4"	358	260	381	513	-	-	-	-	-	-	-	-	-	-	-	-
	6"	440	260	459	513	347	291	365	574	440	319	459	628	-	-	-	-
	8"	498	260	515	513	463	291	486	574	498	319	515	628	366	344	382	679
	10"	550	260	565	513	550	291	565	574	550	319	565	628	458	344	477	679
	12"	550	260	565	513	598	291	612	574	598	319	612	628	549	344	573	679
	15"	550	260	565	513	598	291	612	574	663	319	676	628	663	344	676	679
8"	4"	463	260	508	513	-	-	-	-	-	-	-	-	-	-	-	-
	6"	587	260	612	513	463	291	486	574	587	319	612	628	-	-	-	-
	8"	664	260	687	513	617	291	648	574	664	319	687	628	488	344	509	679
	10"	734	260	754	513	734	291	754	574	734	319	754	628	611	344	636	679
	12"	734	260	754	513	797	291	816	574	797	319	816	628	733	344	764	679
	15"	734	260	754	513	797	291	816	574	885	319	901	628	885	344	901	679
10"	4"	463	260	556	513	-	-	-	-	-	-	-	-	-	-	-	-
	6"	678	260	765	513	553	291	608	574	733	319	765	628	-	-	-	-
	8"	830	260	858	513	738	291	811	574	830	319	858	628	611	344	636	679
	10"	917	260	942	513	917	291	942	574	917	319	942	628	763	344	795	679
	12"	917	260	942	513	997	291	1020	574	997	319	1020	628	916	344	955	679
	15"	917	260	942	513	997	291	1020	574	1106	319	1126	628	1106	344	1126	679

Note: Allowable values have been divided by 2.5 as required by 2007 CBC section 1908.1.16.

DIVISION OF BUILDING AND SAFETY
COUNTY OF VENTURA

BUILDING OFFICIAL _____
Jim MacDonald, C.B.O.

B & S STD **B-92** Sheet 2 of 2

Effective: January 1, 2009