TABLAS PARA EL DISEÑO DE SISTEMAS DE ANCLAJES
según el Capítulo 17 ACI 318-14

Se entregan modelos para elaborar tablas personalizadas que faciliten la aplicación del Capítulo 17. Las tablas se han tomado de la publicación ACI SP-1(11)2 y actualizadas con la correspondencia entre el Apéndice D del ACI 318-11 con el Capítulo 17 del ACI 318-14. También se muestra la validación de algún valor dado en tabla y hacen los comentarios pertinentes.

Tablas 2 y 3.-

Debe corregirse o clarificarse el título, porque la fórmula (D-28; 17.5.1.2.a) es para el cálculo de la capacidad teórica a corte, Vsa, mientras que la (D-2;17.4.1.2) es para el cálculo de la resistencia teórica a tracción.

Table 2—Available strength of unthreaded bolts and studs, lb, N_{sa} (ACI 318-11 Eq. (D-2) and (D-28))

Nominal bolt diameter d_a, in.			1/4	3/8	1/2	5/8	3/4	7/8	1	1-1/8	1-1/4	1-3/8	1-1/2	1-3/4	2
Nominal cross-sectional area, in.^{2}			0.049	0.11	0.196	0.31	0.44	0.6	0.79	1	1.227	1.485	1.767	2.405	3.14
ASTM	f_y, ksi	f_{uta}, ksi	pounds												
A29 A108 AWS D1.1*†	51	65	—	—	12,740	19,955	28,665	39,000	51,025	—	—	—	—	—	—
A193*	105	125	6125	13,750	24,500	38,750	55,000	75,000	98,750	125,000	153,375	185,625	220,875	300,625	392,500
	95	115	—	—	—	—	—	—	—	—	—	—	—	—	—
	75	100	—	—	—	—	—	—	—	—	—	—	—	—	—
A307		60	2940	6600	11,760	18,600	26,400	36,000	47,400	60,000	73,620	89,100	106,020	144,300	188,400
	36	58	2842	6380	11,368	17,980	25,520	34,800	45,820	58,000	71,166	86,130	102,486	139,490	182,120
A36	36	58	2842	6380	11,368	17,980	25,520	34,800	45,820	58,000	71,166	86,130	102,486	139,490	182,120
A449	92	120	5880	13,200	23,520	37,200	52,800	72,000	94,800	—	—	—	—	—	—
	81	105	—	—	—	—	—	—	82,950	105,000	128,835	155,925	185,535	—	—
	58	90	—	—	—	—	—	—	—	—	—	—	159,030	216,450	282,600

*ASTM A193 with tensile strength 115 and 100 ksi are available for bolts with diameters larger than 2-1/2 in.
†Nominal stud area is used.

$A = \frac{\pi d^2}{4} = \frac{\pi\, 0.625^2}{4} = 0.306 \approx 0.31\ in^2$

$N_{sa} = AF_u$
5/8" $A = 0.31$
A307 $F_u = 60$ ksi
$0.31 \times 60 = 18.6 = 18600$

$N_{sa} = A_{se,N}\, f_{uta}$ (D-2) (17.4.1.2)

TABLES

Table 3—Available tensile and shear effective strength of threaded anchors, lb, N_{sa} (ACI 318-11, Eq. (D-2) and (D-28), and Section D.5.1.2) (17.4.1.2)

Nominal bolt diameter d_a, in.			1/4	3/8	1/2	5/8	3/4	7/8	1	1-1/8	1-1/4	1-3/8	1-1/2	1-3/4	2
Effective cross-sectional area, in.^{2}			0.032	0.078	0.142	0.226	0.334	0.462	0.606	0.763	0.969	1.16	1.41	1.9	2.5
Number of threads per pitch			20	16	13	11	10	9	8	7	7	6	6	5	4-1/2
ASTM	f_y, ksi	f_{uta}, ksi	pounds												
A29 A108 AWS D1.1*†	51	65	—	—	9,230	14,690	21,710	30,030	39,390	—	—	—	—	—	—
F1554	36	58	1856	4524	8236	13,108	19,372	26,796	35,148	44,254	56,202	67,280	81,780	110,200	145,000
	55	75	2400	5850	10,650	16,950	25,050	34,650	45,450	57,225	72,675	87,000	105,750	142,500	187,500
	105	125	4000	9750	17,750	28,250	41,750	57,750	75,750	95,375	121,125	145,000	176,250	237,500	312,500
A193*	105	125	4000	9750	17,750	28,250	41,750	57,750	75,750	95,375	121,125	145,000	176,250	237,500	312,500
	95	115	—	—	—	—	—	—	—	—	—	—	—	—	—
	75	100	—	—	—	—	—	—	—	—	—	—	—	—	—
A307	—	60	1920	4680	8520	13,560	20,040	27,720	36,360	45,780	58,140	69,600	84,600	114,000	150,000
	36	58	1856	4524	8236	13,108	19,372	26,796	35,148	44,254	56,202	67,280	81,780	110,200	145,000
A36	36	58	1856	4524	8236	13,108	19,372	26,796	35,148	44,254	56,202	67,280	81,780	110,200	145,000
A449	92	120	3840	9360	17,040	27,120	40,080	55,440	72,720	—	—	—	—	—	—
	81	105	—	—	—	—	—	—	63,630	80,115	101,745	121,800	148,050		
	58	90	—	—	—	—	—	—	—	—	—	—	126,900	171,000	225,000

*ASTM A193 with tensile strength 115 and 100 ksi only bolts with diameters larger than 2-1/2 in. are available.
†Nominal stud area is used.

$A_e \approx 0.75A$; $A = \pi d^2/4 = \pi(0.625^2/4) = 0.306796 \approx 0.3068$

$A_e = 0.75*0.3068 = 0.2301$

$A_e = 0.7854\left(d_b - \frac{0.9743}{n}\right)^2$ (Ver nota Manual Sidor, Tomo 3)

5/8 con n = 11 pg 2-29 Manual LRFD 3ª edición

$A_e = 0.7854\left(0.625 - \frac{0.9743}{11}\right)^2 = 0.226\ in^2$ con acero A29, $F_{uta} = 65$ ksi

$0.226*65\text{ksi} = 14.69 = 14690$ (D-28)

$\sim 0.230*65\text{ksi} = 14.95 = 14950$

Ver Tabla 34-5A PCA p. 34-17

Del Manual Sidor, Tomo III

A_t = área de tracción

$T_u = A_t F_u = \frac{\pi}{4\times 100}\left(d - \frac{24.747}{n}\right)^2 F_u$

con d = diám. nominal del perno

n = número de roscas por pulgada.

transformación del área nominal, A_d) en directa porque la razón varía de 0.75 en diám de 3/4" a 0.79 en diám. de 1 1/8"

Conservadoramente $T_u = A_t F_u \approx 0.75 A_d F_u$

aplicando un FS = 2.0

$T_u = A_d\left(\frac{0.75 F_u}{FS}\right) = A_d F_1$

siendo F_1 = 1410 para pernos A302 con FS = 2.25
= 3090 kg/cm² para A325 con FS = 2.05
= 3800 para A490 con FS = 2.08

Por corte $\tau_u = 0.62 F_u$ en promedio

Tablas 4.- Son tablas para calcular la resistencia del concreto a la rotura por tracción según la Sección 17.4.2 (D.5.2), por eso el subíndice $_{bo}$, breakout , y los dígitos 24, 17, 16 a los coeficientes (10,7,5.8) resultando que el valor entregado es

$$N_b = K_{tabulado}\,\lambda_a$$

$$\text{Con } K_{tabulado} = \text{dígito}\ \sqrt{Fc}\ h_{ef}^{exponente}$$

El exponente es diferente en la Fórmula 17.4.2.2.2a y 17.4.2.2b

Table 4.1—K_{bo24} for various values of f_c' and h_{ef}

h_{ef}, in. \ f_c', psi	3000 210	4000 280	5000 350	6000	7000	8000	9000	10,000 70
3	6831	7887	8818	9660	10,434	11,154	11,831	12,471
3.5	8607	9939	11,112	12,173	13,148	14,056	14,909	15,715
4	10,516	12,143	13,576	14,872	16,064	17,173	18,215	19,200
4.5	12,548	14,490	16,200	17,746	19,168	20,492	21,735	22,910
5	14,697	16,971	18,974	20,785	22,450	24,000	25,456	26,833
5.5	16,956	19,579	21,890	23,979	25,900	27,689	29,368	30,957
6	19,320	22,308	24,942	27,322	29,511	31,549	33,463	35,273
6.5	21,784	25,154	28,123	30,808	33,276	35,573	37,731	39,772
7	24,346	28,112	31,430	34,430	37,188	39,756	42,168	44,449
7.5	27,000	31,177	34,857	38,184	41,243	44,091	46,765	49,295
8	29,745	34,346	38,400	42,065	45,435	48,573	51,519	54,306
8.5	32,576	37,616	42,056	46,070	49,761	53,197	56,424	59,476
9	35,492	40,983	45,821	50,194	54,216	57,959	61,475	64,800
9.5	38,491	44,445	49,691	54,434	58,796	62,855	66,668	70,274
10	41,569	48,000	53,666	58,788	63,498	67,882	72,000	75,895
10.5	44,726	51,645	57,740	63,251	68,319	73,037	77,467	81,657

Con $f'_c = 6000$; $h_{ef} = 5$

$K_{bo24} = 24\sqrt{6000}\ 5^{1.5} = 20784.61$ pounds.

Ver Tabla 34-5A PCA pg 34-17

Tablas 5.- Tabulan la Fórmula (17.4.3.4) para la resistencia por desprendimiento del concreto a tracción (*pullout*) diferentes tipos de anclajes de las Tabla 1, en cuanto se diferencien en el área A_{brg}: anclajes con cabeza cuadrada; anclajes de cabeza hexagonal y barras roscadas con tuerca hexagonal; anclajes con cabeza hexagonal pesada y barras roscadas con tuercas hexagonal pesada; anclajes con cabeza soldada (*welded headed studs*); barra roscada con tuerca cuadrada; barra roscada con tuerca cuadrada pesada.

Table 5.1—Basic concrete pullout strength of square headed bolt, lb

	f_c', psi	3000	4000	5000	6000	7000	8000	9000	10,000
Diameter, in.	A_{brg}, in.^{2}								
3/8	0.206	4944	6592	8240	9888	11,536	13,184	14,832	16,480
1/2	0.366	8784	11,712	14,640	17,568	20,496	23,424	26,352	29,280
5/8	0.572	13,728	18,304	22,880	27,456	32,032	36,608	41,184	45,760
3/4	0.824	19,776	26,368	32,960	39,552	46,144	52,736	59,328	65,920
7/8	1.121	26,904	35,872	44,840	53,808	62,776	71,744	80,712	89,680
1	1.465	35,160	46,880	58,600	70,320	82,040	93,760	105,480	117,200
1-1/8	1.854	44,496	59,328	74,160	88,992	103,824	118,656	133,488	148,320
1-1/4	2.288	54,912	73,216	91,520	109,824	128,128	146,432	164,736	183,040
1-3/8	2.769	66,456	88,608	110,760	132,912	155,064	177,216	199,368	221,520
1-1/2	3.295	79,080	105,440	131,800	158,160	184,520	210,880	237,240	263,600

Tablas 6.- Resistencia de anclajes individuales en tracción al desprendimiento,N_p, (*pullout*) . Las tablas varían con los valores de e_h, entre $3d_a \leq$ da $\leq 4.5\ d_a$

Table 6.1—Values for N_p for various f_c' and bolt diameters with e_h = 3(dia.)

Diameter, in. \ f_c', psi	3000	4000	5000	6000	7000	8000	9000	10,000
3/8	1139	1519	1898	2278	2658	3038	3417	3797
1/2	2025	2700	3375	4050	4725	5400	6075	6750
5/8	3164	4219	5273	6328	7383	8438	9492	10,547
3/4	4556	6075	7594	9113	10,631	12,150	13,669	15,188
7/8	6202	8269	10,336	12,403	14,470	16,538	18,605	20,672
1	8100	10,800	13,500	16,200	18,900	21,600	24,300	27,000
1-1/8	10,252	13,669	17,086	20,503	23,920	27,338	30,755	34,172
1-1/4	12,656	16,875	21,094	25,313	29,531	33,750	37,969	42,188
1-1/2	18,225	24,300	30,375	36,450	42,525	48,600	54,675	60,750
1-3/4	24,806	33,075	41,344	49,613	57,881	66,150	74,419	82,688
2	32,400	43,200	54,000	64,800	75,600	86,400	97,200	108,000

Tablas 7.- Los valores del factor de modificación por excentricidad, según las fórmulas (17.4.2.4) y (17.4.2.5a y b). En este último caso, se indican el valor de c_{ac} dependiente del tipo de anclaje con el que ha calculado la Tabla

Table 7.3—c_{ac} values taken for the following anchor

Anchor type	c_{ac}, in.*
Adhesive anchors	$2h_{ef}$
Undercut anchors	$2.5h_{ef}$
Torque-controlled expansion anchors	$4h_{ef}$
Displacement-controlled expansion anchors	$4h_{ef}$

*Alternatively, c_{ac} is obtained in accordance with ACI 355.2.

Table 7.1—Modification factor for eccentrically loaded anchor group, $\psi_{ec,N}$

h_{ef}, in. \ e_N', in.	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	6	7	8	9	10	11	12
3	0.90	0.818	0.75	0.692	0.643	0.60	0.563	0.529	0.50	0.474	0.429	0.391	0.36	0.333	0.31	0.29	0.273
4	0.923	0.857	0.80	0.75	0.706	0.667	0.632	0.60	0.571	0.545	0.50	0.462	0.429	0.40	0.375	0.353	0.333
5	0.938	0.882	0.833	0.789	0.75	0.714	0.682	0.652	0.625	0.60	0.556	0.517	0.484	0.455	0.429	0.405	0.385
6	0.947	0.90	0.857	0.818	0.783	0.75	0.72	0.692	0.667	0.643	0.60	0.563	0.529	0.50	0.474	0.45	0.429
7	0.955	0.913	0.875	0.84	0.808	0.778	0.75	0.724	0.70	0.677	0.636	0.60	0.568	0.538	0.512	0.488	0.467
8	0.96	0.923	0.889	0.857	0.828	0.80	0.774	0.75	0.727	0.706	0.667	0.632	0.60	0.571	0.545	0.522	0.50
9	0.964	0.931	0.90	0.871	0.844	0.818	0.794	0.771	0.75	0.73	0.692	0.659	0.628	0.60	0.574	0.551	0.529
10	0.968	0.938	0.909	0.882	0.857	0.833	0.811	0.789	0.769	0.75	0.714	0.682	0.652	0.625	0.60	0.577	0.556
11	0.971	0.943	0.917	0.892	0.868	0.846	0.825	0.805	0.786	0.767	0.733	0.702	0.673	0.647	0.623	0.60	0.579
12	0.973	0.947	0.923	0.90	0.878	0.857	0.837	0.818	0.80	0.783	0.75	0.72	0.692	0.667	0.643	0.621	0.60
13	0.975	0.951	0.929	0.907	0.886	0.867	0.848	0.83	0.813	0.796	0.765	0.736	0.709	0.684	0.661	0.639	0.619
14	0.977	0.955	0.933	0.913	0.894	0.875	0.857	0.84	0.824	0.808	0.778	0.75	0.724	0.70	0.677	0.656	0.636
15	0.978	0.957	0.938	0.918	0.90	0.882	0.865	0.849	0.833	0.818	0.789	0.763	0.738	0.714	0.692	0.672	0.652
16	0.98	0.96	0.941	0.923	0.906	0.889	0.873	0.857	0.842	0.828	0.80	0.774	0.75	0.727	0.706	0.686	0.667
18	0.982	0.964	0.947	0.931	0.915	0.90	0.885	0.871	0.857	0.844	0.818	0.794	0.771	0.75	0.73	0.711	0.692
20	0.984	0.968	0.952	0.938	0.923	0.909	0.896	0.882	0.87	0.857	0.833	0.811	0.789	0.769	0.75	0.732	0.714
22	0.985	0.971	0.957	0.943	0.93	0.917	0.904	0.892	0.88	0.868	0.846	0.825	0.805	0.786	0.767	0.75	0.733
24	0.986	0.973	0.96	0.947	0.935	0.923	0.911	0.90	0.889	0.878	0.857	0.837	0.818	0.80	0.783	0.766	0.75
25	0.987	0.974	0.962	0.949	0.938	0.926	0.915	0.904	0.893	0.882	0.862	0.843	0.824	0.806	0.789	0.773	0.758

Table 7.2—Modification factor for edge effect for a single anchor or a group of anchors loaded in tension, $\Psi_{ed,N}$

h_{ef}, in. \ $c_{a,min}$, in.	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
3	0.833	0.90	0.967	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
4	0.80	0.85	0.90	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
5	0.78	0.82	0.86	0.90	0.94	0.98	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
6	0.767	0.80	0.833	0.867	0.90	0.933	0.967	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
7	0.757	0.786	0.814	0.843	0.871	0.90	0.929	0.957	0.986	1.00	1.00	1.00	1.00	1.00	1.00
8	0.75	0.775	0.80	0.825	0.85	0.875	0.90	0.925	0.95	0.975	1.00	1.00	1.00	1.00	1.00
9	0.744	0.767	0.789	0.811	0.833	0.856	0.878	0.90	0.922	0.944	0.967	0.989	1.00	1.00	1.00
10	0.74	0.76	0.78	0.80	0.82	0.84	0.86	0.88	0.90	0.92	0.94	0.96	0.98	1.00	1.00
11	0.736	0.755	0.773	0.791	0.809	0.827	0.845	0.864	0.882	0.90	0.918	0.936	0.955	0.973	0.991
12	0.733	0.75	0.767	0.783	0.80	0.817	0.833	0.85	0.867	0.883	0.90	0.917	0.933	0.95	0.967
13	0.731	0.746	0.762	0.777	0.792	0.808	0.823	0.838	0.854	0.869	0.885	0.90	0.915	0.931	0.946
14	0.729	0.743	0.757	0.771	0.786	0.80	0.814	0.829	0.843	0.857	0.871	0.886	0.90	0.914	0.929
15	0.727	0.74	0.753	0.767	0.78	0.793	0.807	0.82	0.833	0.847	0.86	0.873	0.887	0.90	0.913
16	0.725	0.738	0.75	0.763	0.775	0.788	0.80	0.813	0.825	0.838	0.85	0.863	0.875	0.888	0.90
17	0.724	0.735	0.747	0.759	0.771	0.782	0.794	0.806	0.818	0.829	0.841	0.853	0.865	0.876	0.888
18	0.722	0.733	0.744	0.756	0.767	0.778	0.789	0.80	0.811	0.822	0.833	0.844	0.856	0.867	0.878
20	0.72	0.73	0.74	0.75	0.76	0.77	0.78	0.79	0.80	0.81	0.82	0.83	0.84	0.85	0.86
22	0.718	0.727	0.736	0.745	0.755	0.764	0.773	0.782	0.791	0.80	0.809	0.818	0.827	0.836	0.845
24	0.717	0.725	0.733	0.742	0.75	0.758	0.767	0.775	0.783	0.792	0.80	0.808	0.817	0.825	0.833
25	0.716	0.724	0.732	0.74	0.748	0.756	0.764	0.772	0.78	0.788	0.796	0.804	0.812	0.82	0.828

$C_{a,min} = 10$

$h_{ef} = 9$

$\psi_{ed,N} = 0.7 + 0.3 \frac{10}{1.5 \times 9} = 0.9222$

Table 7.4—Modification factor for post-installed undercut anchors loaded in tension, $c_{ac} = 2.5h_{ef}$

h_{ef}, in. \ $c_{a,min}$, in.	<3	3.5	4	4.5	5	5.5	6	6.5	7	8	9	10	11	12	13	14	15
3	0.60	0.6	0.6	0.60	0.667	0.733	0.80	0.867	0.933	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
4	0.60	0.60	0.60	0.6	0.60	0.60	0.60	0.65	0.70	0.80	0.90	1.00	1.00	1.00	1.00	1.00	1.00
5	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.64	0.72	0.80	0.88	0.96	1.00	1.00	1.00
6	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.667	0.733	0.80	0.867	0.933	1.00
7	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.629	0.686	0.743	0.80	0.857
8	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.65	0.70	0.75
9	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.622	0.667
10	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60
11	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60
12	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60
13	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60
14	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60
>15	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60

Tablas 8.- Para varios valores de la resistencia del concreto Fc

TABLES

Table 8: *Section D.6.2—Concrete breakout strength of anchor in shear*

Section D.6.2.2—Basic concrete breakout strength in shear of a single anchor in cracked concrete shall be the smaller of Eq. (D-33) and (D-34).

$$V_b = \left(7\left(\frac{\ell_e}{d_a}\right)^{0.2}\sqrt{d_a}\right)\lambda_a\sqrt{f'_c}\,(c_{a1})^{1.5} \qquad \text{(D-33)}$$

$$V_b = 9\lambda_a\sqrt{f'_c}\,(c_{a1})^{1.5} \qquad \text{(D-34)}$$

$$K_{boV7} = \left(7\left(\frac{\ell_e}{d_a}\right)^{0.2}\sqrt{d_a}\right)\sqrt{f'_c} \quad \text{with } \ell_e = h_{ef} \le 8d_a$$

$$V_b = K_{boV7}\lambda_a(c_{a1})^{1.5} \quad \text{(Ib)}$$

Values of K_{boV7} for various values of ℓ_e and d_a.

Table 8.1—f_c' = 3000 psi

d_a, in. \ ℓ_e, in.	3	4	5	≥6
3/8	356	356	356	356
1/2	388	411	411	411
5/8	415	439	459	459
3/4	438	464	485	493
7/8	459	486	493	493
1	478	493	493	493
1-1/8 to 2	493	493	493	493

Table 8.3—f_c' = 5000 psi

d_a, in. \ ℓ_e, in.	3	4	5	≥6
3/8	459	459	459	459
1/2	501	531	531	531
5/8	536	567	593	593
3/4	566	599	626	636
7/8	592	627	636	636
1	617	636	636	636
1-1/8 to 2	636	636	636	636

Section D.6.2.2—Basic concrete breakout strength in shear of a single torque-controlled expansion anchor in cracked concrete with a distance sleeve separated from expansion sleeve shall be the smaller of Eq. (D-33) and (D-34).

$$V_b = \left(7\left(\frac{\ell_e}{d_a}\right)^{0.2}\sqrt{d_a}\right)\lambda_a\sqrt{f'_c}\,(c_{a1})^{1.5} \qquad \text{(D-33)}$$

$$V_b = 9\lambda_a\sqrt{f'_c}\,(c_{a1})^{1.5} \qquad \text{(D-34)}$$

$$K_{boV7} = \left(7\left(\frac{\ell_e}{d_a}\right)^{0.2}\sqrt{d_a}\right)\sqrt{f'_c} \quad \text{with } \ell_e = 2d_a$$

$$V_b = K_{boV7}\lambda_a(c_{a1})^{1.5} \quad \text{(Ib)}$$

Table 8.17—Values of K_{boV7} for various values of ℓ_e, d_a, and f_c'

d_a, in. \ f_c', in.	3000	4000	5000	6000	7000	8000	9000	10,000
3/8	270	311	348	381	412	440	467	492
1/2	311	360	402	440	476	509	539	569
5/8	348	402	449	492	532	569	603	636
3/4	381	440	492	539	583	623	661	696
7/8	412	476	532	583	629	673	714	752
1	440	509	569	623	673	719	763	804
1-1/8	467	539	603	661	714	763	809	853
1-1/4	492	569	636	696	752	804	853	899
1-3/8	493	569	636	697	753	805	854	900
1-1/2	493	569	636	697	753	805	854	900
1-3/4	493	569	636	697	753	805	854	900
2	493	569	636	697	753	805	854	900

Above the heavy line, Eq. (D-33) controls.

Tablas 9.-

Table 9 (cont.)

Section D.6.2.6—Modification factor for edge effect for a single or group of anchors load in shear. (17.5.2.6)

If $c_{a,2} \geq 1.5c_{a1}$, then $\psi_{ed,V} = 1.0$ ~~(D-37)~~ (17.5.2.6a)

If $c_{a,2} < 1.5c_{a1}$, then $\psi_{ed,V} = 0.7 + 0.3\frac{c_{a2}}{1.5c_{a1}}$ (D-38) (17.5.2.6b)

$c_{a1} = 8$ $c_{a2} = 4.5$ $\psi_{ed,V} = 0.7 + 0.3\frac{4.5}{1.5 \times 8} = 0.812$

Table 9.2—Modification factor for edge effect, $\psi_{ed,V}$

c_{a2}, in. \ c_{a1}, in.	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	10	11	12
2	0.900	0.860	0.833	0.814	0.800	0.789	0.780	0.773	0.767	0.762	0.757	0.753	0.750	0.747	0.744	0.740	0.736	0.733
2.5	0.950	0.900	0.867	0.843	0.825	0.811	0.800	0.791	0.783	0.777	0.771	0.767	0.763	0.759	0.756	0.750	0.745	0.742
3	1.00	0.940	0.900	0.871	0.850	0.833	0.820	0.809	0.800	0.792	0.786	0.780	0.775	0.771	0.767	0.760	0.755	0.750
3.5	1.00	0.980	0.933	0.900	0.875	0.856	0.840	0.827	0.817	0.808	0.800	0.793	0.788	0.782	0.778	0.770	0.764	0.758
4	1.00	1.00	0.967	0.929	0.900	0.878	0.860	0.845	0.833	0.823	0.814	0.807	0.800	0.794	0.789	0.780	0.773	0.767

Table 9 (cont.):

Section D.6.2.8—Modification factor for anchors located in a concrete member where $h_a < 1.5c_{a1}$ and loaded in shear.

$$\psi_{h,V} = \sqrt{\frac{1.5c_{a1}}{h_a}}$$ ~~(D-39)~~ (17.5.2.8)

$c_{a1} = 7$
$h_a = 5$
$\psi_{h,V} = \sqrt{\frac{1.5 \times 7}{5}} = 1.449$

$\psi_{h,V}$ shall not be taken less than 1.0.

Table 9.3—Modification factor for edge effect, $\psi_{h,V}$

h_a, in. \ c_{a1}, in.	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	10	11	12
2	1.225	1.369	1.500	1.620	1.732	1.837	1.936	2.031	2.121	2.208	2.291	2.372	2.449	2.525	2.598	2.739	2.872	3.000
2.5	1.095	1.225	1.342	1.449	1.549	1.643	1.732	1.817	1.897	1.975	2.049	2.121	2.191	2.258	2.324	2.449	2.569	2.683
3	1.00	1.118	1.225	1.323	1.414	1.500	1.581	1.658	1.732	1.803	1.871	1.936	2.000	2.062	2.121	2.236	2.345	2.449
3.5	1.00	1.035	1.134	1.225	1.309	1.389	1.464	1.535	1.604	1.669	1.732	1.793	1.852	1.909	1.964	2.070	2.171	2.268
4	1.00	1.00	1.061	1.146	1.225	1.299	1.369	1.436	1.500	1.561	1.620	1.677	1.732	1.785	1.837	1.936	2.031	2.121
4.5	1.00	1.00	1.00	1.080	1.155	1.225	1.291	1.354	1.414	1.472	1.528	1.581	1.633	1.683	1.732	1.826	1.915	2.00
5	1.00	1.00	1.00	1.025	1.095	1.162	1.225	1.285	1.342	1.396	1.449	1.500	1.549	1.597	1.643	1.732	1.817	1.897
5.5	1.00	1.00	1.00	1.00	1.044	1.108	1.168	1.225	1.279	1.331	1.382	1.430	1.477	1.523	1.567	1.651	1.732	1.809
6	1.00	1.00	1.00	1.00	1.00	1.061	1.118	1.173	1.225	1.275	1.323	1.369	1.414	1.458	1.500	1.581	1.658	1.732
6.5	1.00	1.00	1.00	1.00	1.00	1.019	1.074	1.127	1.177	1.225	1.271	1.316	1.359	1.401	1.441	1.519	1.593	1.664