Appendix

(Table 1) – ACI 347

Unit weight coefficient *Cw*:

Inch-pound version		SI version	
Unit weight of concrete	C_w	Density of concrete	C_w
Less than 140 lb/ft^3	$C_w = 0.5[1 + (w/145 \text{ lb/ft}^3)]$ but not less than 0.80	Less than 2240 kg/m^3	$C_w = 0.5[1 + (w/2320 \text{ kg/m}^3)]$ but not less than 0.80
140 to 150 lb/ft^3	1.0	2240 to 2400 kN/m^3	1.0
More than 150 lb/ft^3	$C_w = w/145 \text{ lb/ft}^3$	More than 2400 kg/m^3	$C_w = w/2320 \text{ kg/m}^3$

Note: w = unit weight (density) of concrete, lb/ft³ (kg/m3).

(Table 2) – ACI 347

Chemistry coefficient *Cc*:

Cement type or blend	C_c
Types I, II, and III without retarders*	1.0
Types I, II, and III with a retarder	1.2
Other types or blends containing less than 70% slag or 40% fly ash without retarders*	1.2
Other types or blends containing less than 70% slag or 40% fly ash with a retarder*	1.4
Blends containing more than 70% slag or 40% fly ash	1.4

*Retarders include any admixture, such as a retarder, retarding water reducer, retarding midrange water-reducing admixture, or high-range water-reducing admixture (superplasticizer), that delays setting of concrete.

(Table 3)

Maximum bending, shear, and deflection in a uniformly loaded beam:

Type	Support Conditions		
	1 Span	2 Spans	3 Spans
Bending moment	$M = \frac{wl^2}{8}$	$M = \frac{wl^2}{8}$	$M = \frac{wl^2}{10}$
Shear	$V = \frac{wl}{2}$	$V = \frac{5wl}{8}$	$V = \frac{3wl}{5}$
Deflection	$\Delta = \frac{5wl^4}{384\,EI}$	$\Delta = \frac{wl^4}{185EI}$	$\Delta = \frac{wl^4}{145EI}$

(Table 4)

Concrete form design equation (*to determine allowable span length****):***

	One span	Two spans	Three or more spans
Bending moment	$\ell = 9.8\sqrt{\dfrac{Fb\ S}{w}}$	$\ell = 9.8\sqrt{\dfrac{Fh\ S}{w}}$	$\ell = 10.95\sqrt{\dfrac{Fb\ S}{w}}$
Shear	$\ell = \dfrac{16\ Fv\ A}{w} + 2d$ $\ell^{a} = \dfrac{24\ Fv\ (lb/Q)}{w} + 2d$	$\ell = \dfrac{12.8\ Fv\ A}{w} + 2d$ $\ell^{a} = \dfrac{19.2\ Fv\ (lb/Q)}{w} + 2d$	$\ell = \dfrac{13.3\ Fv\ A}{w} + 2d$ $\ell^{a} = \dfrac{20\ Fv\ (lb/Q)}{w} + 2d$
Deflection $\Delta_{all.} = \dfrac{l}{240}$	$\ell = 1.57\sqrt[3]{\dfrac{EI}{w}}$	$\ell = 2.1\sqrt[3]{\dfrac{EI}{w}}$	$\ell = 1.94\sqrt[3]{\dfrac{EI}{w}}$
Deflection $\Delta_{all.} = \dfrac{l}{360}$	$\ell = 1.37\sqrt[3]{\dfrac{EI}{w}}$	$\ell = 1.83\sqrt[3]{\dfrac{EI}{w}}$	$\ell = 1.69\sqrt[3]{\dfrac{EI}{w}}$
When deflection Δ (in.) is specified	$\ell = 5.51\sqrt[4]{\dfrac{\Delta EI}{w}}$	$\ell = 6.86\sqrt[4]{\dfrac{\Delta EI}{w}}$	$\ell = 6.46\sqrt[4]{\dfrac{\Delta EI}{w}}$

$*\ell^{a}$ For plywood only.

(Table 5)

Section properties and design values for plyform:

Thickess t (in).	Approx. weight (psf)	Properties for stress applied parallel with face grain			Properties for stress applied perpendicular to face grain		
		Moment of inertia I ($in.^4$/ft)	Effective section modulus KS (in.³/ft)	Rolling shear const. lb/Q (in.²/ft)	Momet of inertia I ($in.^4$/ft)	Effective section modulus KS (in.³/ft)	Rolling shear const. lb/Q (in.²/ft)
Class I							
1/2	1.5	0.077	0.268	5.153	0.024	0.130	2.739
5/8	1.8	0.130	0.358	5.717	0.038	0.175	3.094
3/4	2.2	0.199	0.455	7.187	0.092	0.306	4.063
7/8	2.6	0.296	0.584	8.555	0.151	0.422	6.028
1	3.0	0.427	0.737	9.374	0.270	0.634	7.014
Class II							
1/2	1.5	0.075	0.267	4.891	0.020	0.167	2.727
5/8	1.8	0.130	0.357	5.593	0.032	0.225	3.074
3/4	2.2	0.199	0.454	6.631	0.075	0.392	4.049
7/8	2.6	0.300	0.591	7.990	0.123	0.542	5.997
1	3.0	0.421	0.754	8.614	0.220	0.812	6.987
Structural I							
1/2	1.5	0.078	0.271	4.908	0.029	0.178	2.725
5/8	1.8	0.131	0.361	5.258	0.045	0.238	3.073
3/4	2.2	0.202	0.464	6.189	0.108	0.418	4.047
7/8	2.6	0.317	0.626	7.539	0.179	0.579	5.991
1	3.0	0.479	0.827	7.978	0.321	0.870	6.981

(Table 5)

Continued:

	Design values		
	Plyform class I	**Plyform class II**	**Structural I Plyform**
Modulus of elasticity (psi)	1,650,000	1,430,000	1,650,000
Bending stress (psi)	1930	1330	1930
Rolling shear stress (psi)	72	72	102

Source: APA—The Engineered Wood Association.

Note: All properties adjusted to account for reduced effectiveness of plies with grain perpendicular to applied stress.

(Table 6)

Properties of structural lumber:

Nominal size (in.)	Standard dressed size (S4S) (in.)	Area of section, A ($in.^2$)	Moment of inertia,[a] I ($in.^4$)	Section modulus,[a] S ($in.^3$)	weight[b] (lb/ft)
2 × 4	1½ × 3½	5.25	5.36	3.06	1.28
2 × 6	1½ × 5½	8.25	20.80	7.56	2.01
2 × 8	1½ × 7¼	10.88	47.63	13.14	2.64
2 × 10	1½ × 9¼	13.88	98.93	21.39	3.37
2 × 12	1½ × 11¼	16.88	178.0	31.64	4.10
3 × 6	2½ × 5½	13.75	34.66	12.60	3.34
3 × 8	2½ × 7¼	18.13	79.39	21.90	4.41
3 × 10	2½ × 9¼	23.13	164.9	35.65	5.62
3 × 12	2½ × 11¼	28.13	296.6	52.73	6.84
4 × 4	3½ × 3½	12.25	12.51	7.15	2.98
4 × 6	3½ × 5½	19.25	48.53	17.65	4.68
4 × 8	3½ × 7¼	25.38	111.1	30.66	6.17
4 × 10	3½ × 9¼	32.38	230.8	49.91	7.87
4 × 12	3½ × 11¼	39.38	415.3	73.83	9.57
6 × 6	5½ × 5½	30.25	76.26	27.73	7.35
6 × 8	5½ × 7¼	41.25	193.4	51.56	10.03
6 × 10	5½ × 9¼	52.25	393.0	82.73	12.70
6 × 12	5½ × 11¼	63.25	697.1	121.2	15.37

[a] I and S are about the strong axis.

[b]Weight in lb/ft when the unit of wood is 35 lb/ft^3.

(Table 7)

Base design values for visually graded dimension lumber (normal load duration and dry service condition):

#2 grade (2″- 4″ thick, 2″ and wider):

Species	Design values (psi)					
	F_b	F_t	F_v	$F_{c\perp}$	F_c	E
Douglas fir-larch	900	575	180	625	1350	1,600,000
Douglas fir-south	850	525	180	520	1350	1,200,000
Hem-fir	850	525	150	405	1300	1,300,000
Spruce-pine-fir	875	450	135	425	1150	1,400,000

Construction grade (2″- 4″ thick, 2″- 4″ and wider):

Species	Design values (psi)					
	F_b	F_t	F_v	$F_{c\perp}$	F_c	E
Douglas fir-larch	1000	650	180	625	1650	1,500,000
Douglas fir-south	975	600	180	520	1650	1,200,000
Hem-fir	975	600	150	405	1550	1,300,000
Spruce-pine-fir	1000	500	135	425	1400	1,300,000

(Table 7)

Continued:

Southern pine (2″- 4″ thick):

#2 Grade	Design values (psi)					
	F_b	F_t	F_v	$F_{c\perp}$	F_c	E
2″- 4″ wide	1500	825	175	565	1650	1,600,000
5″- 6″ wide	1250	725	175	565	1600	1,600,000
8″ wide	1200	650	175	565	1550	1,600,000
10″ wide	1050	575	175	565	1500	1,600,000
12″ wide	975	550	175	565	1450	1,600,000
Construction grade 4″ wide	1100	625	175	565	1800	1,500,000

Adjustment factors	F_b	F_t	F_v	$F_{c\perp}$	F_c	E
Load duration C_D*	1.25	1.25	1.25	—	1.25	—
Wet service C_M	0.85**	1.0	0.97	0.67	0.80**	0.90

Source: Courtesy of American Forest & Paper Association

*Values shown are typical for forming application.

**When $F_b (C_F) \leq 1150$ psi, $C_M = 1.0$.

**When $F_c (C_F) \leq 750$ psi, $C_M = 1.0$; for southern pine, when $F_c \leq 750$ psi, $C_M = 1.0$.

(Table 8)

Size and flat use factors for bending stress F_b:

Width of lumber	Size factor C_F[a]			Flat use factor C_{fu}[b]	
	2″ - 3″ thick	4″ thick		2″- 3″ thick	4″ thick
2″ - 3″	1.5	1.5		1.0	—
4″	1.5	1.5		1.1	1.0
5″	1.4	1.4		1.1	1.05
6″	1.3	1.3		1.15	1.05
8″	1.2	1.3		1.15	1.05
10″	1.1	1.2		1.2	1.1
12″	1.0	1.1		1.2	1.1

Source: Courtesy of American Forest & Paper Association.

[a]Applicable to No.2 grade.

[b]Applicable to No.2 grade and construction grade.

(Table 9)

Size factor C_F for compression parallel to the grain:

Width of lumber	Size factor C_F	
	No.2 grade	construction grade
2″ - 4″	1.15	1.0
5″	1.1	—
6″	1.1	—
8″	1.05	—
10″	1.0	—
12″	1.0	—

Source: Courtesy of American Forest & Paper Association.

(Table 10)

Safe span in inches for class I plyform, continuous over four or more supports:

	Stress parallel to gain				Stress perpendicular to gain			
Pressure (psf)	**1/2 in.**	**5/8 in.**	**3/4 in.**	**1 in.**	**1/2 in.**	**5/8 in.**	**3/4 in.**	**1 in.**
75	20	24	26	32	14	16	21	28
100	18	22	24	30	12	14	19	26
125	17	20	23	28	12	13	18	25
150	16	19	22	27	11	13	17	24
175	15	18	21	26	10	12	16	23
200	15	17	20	25	10	11	15	22
300	13	15	17	22	9	10	13	19
400	12	14	16	20	8	9	12	18
500	11	13	15	18	7	8	11	16
600	10	12	13	17	7	8	11	15
700	9	11	12	16	6	8	10	14
800	9	10	11	15	6	7	9	14
900	8	10	11	14	5	6	8	13
1000	8	9	10	13	5	6	7	12
1100	8	9	10	12	5	5	7	11
1200	7	8	9	12	4	5	6	10
1300	7	8	9	11	4	5	6	10
1400	6	7	9	11	4	4	6	9
1500	6	7	8	11	4	4	5	9
1600	6	6	8	10	—	4	5	8

(Table 10)

Continued:

	Stress parallel to gain					Stress perpendicular to gain			
Pressure (psf)	**1/2 in.**	**5/8 in.**	**3/4 in.**	**1 in.**		**1/2 in.**	**5/8 in.**	**3/4 in.**	**1 in.**
1700	5	6	8	10		—	4	5	8
1800	5	6	7	9		—	4	5	8
1900	5	6	7	9		—	4	5	7
2000	5	5	7	9		—	—	4	7
2200	4	5	6	8		—	—	4	7
2400	4	5	6	8		—	—	4	6
2600	4	4	5	7		—	—	4	6
2800	4	4	5	7		—	—	4	6
3000	—	4	5	6		—	—	—	5

(Table 11)

Clamp spacing determination:

y^a (ft)	Pressure (psf)	Maximum clamp spacing (in.)[b]
0	1800	7
3	1350	9
6	900	11
9	450	15
11.5	75	16

[a]Quantity y is measured upward from the bottom of the form.

[b]From Table (10).

(Table 12)

Effective length factor Ke:

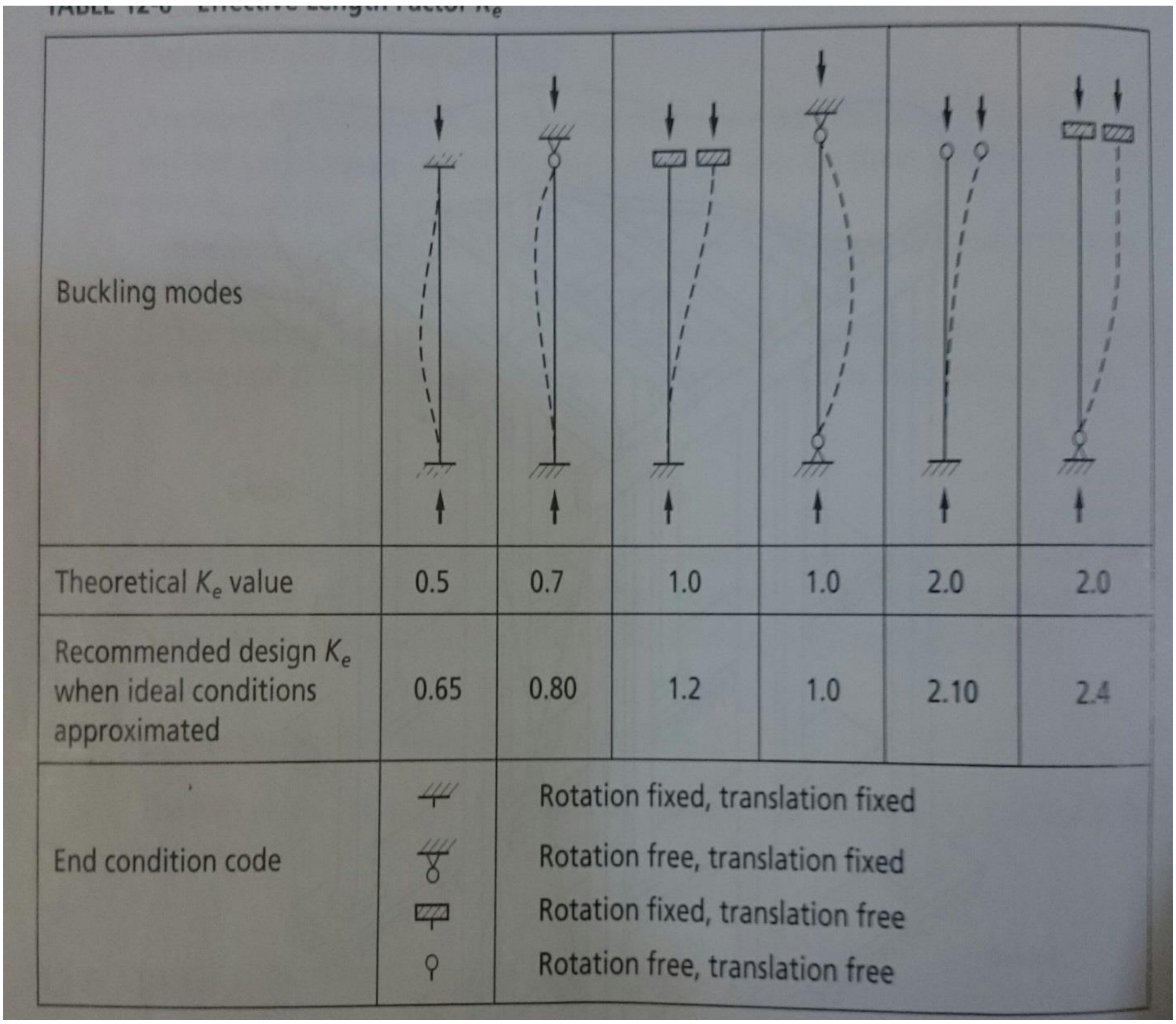

TABLE 12-6 Effective Length Factor K_e

Buckling modes						
Theoretical K_e value	0.5	0.7	1.0	1.0	2.0	2.0
Recommended design K_e when ideal conditions approximated	0.65	0.80	1.2	1.0	2.10	2.4
End condition code	Rotation fixed, translation fixed Rotation free, translation fixed Rotation fixed, translation free Rotation free, translation free					

(Table 13)

Minimum safety factors of formwork accessories:

Accessory	Safety factor	Type of construction
Form tie	2.0	All applications
Form anchor	2.0	Formwork supporting form weight and concrete pressures only
	3.0	Formwork supporting weight of forms, concrete, construction live loads, and impact
Form hangers	2.0	All applications
Anchoring inserts used as form ties	2.0	Precast-concrete panels when used as formwork

*Safety factors are based on the ultimate strength of the accessory when new.