EXTRACTS FROM THE BUILDING LAWS OF VARIOUS CITIES.

Live Loads for Floors in Different Classes of Buildings, Exclusive of the Weight of the Materials of Construction.

(Revised to 1913.) **Pounds per Square Foot.**

No.	City.	Dwell'g, Apartments, Hotels, Tenements or Lodgings.	Office Buildings.		Schools or Places of Instruction.	Buildings for Public Assembly.
			First Floor.	Upper Floors.		
1	Atlanta	60	150	75	75	90
2	Baltimore	60	150	75	75	75(a) 125
3	Boston	100(b) 50	100	100	125(c) 60	125
4	Buffalo	40(d) 70	70	70	100	100
5	Chicago	50(e) 40	50	50	75	100
6	Cincinnati	40	100	50	60	100
7	Cleveland	40(u) 50	60	60	80(c) 60	80(a) 100
8	Denver(w)	.....	.....	.....	.....	.....
9	Detroit	80(f) 50	125	75	100(c) 75	80(a) 100
10	Hartford	50	100	100	.....	125
11	Jersey City	60	150	75	75	90
12	Los Angeles	125(t) 60	75	75	.....	125
13	Louisville	60	150	75	75	100
14	Milwaukee(w)	.....	.....	.....	.....	.....
15	Minneapolis	50	100	75	100	125
16	Newark, N. J.	60	150	75	75	90
17	New Haven	100(g) 60	.....	.....	75	110
18	New Orleans	70(b) 40	70	70	125(c) 60	125
19	New York	60	150	75	75	90
20	Philadelphia	70	100	100	.....	120
21	Pittsburgh	70(u)	.....	.....	.....	150
22	Portland, Ore.	80(f) 50	100	60	80(c) 60	80(a) 100
23	Providence	100(b) 50	150	75	125(c) 60	125
24	Rochester	60(h) 50	70	70	70	70
25	St. Louis	100(f) 60	150	70	100	100
26	St. Paul	60	125	60	125(c) 60	125
27	San Francisco	60	60	60	125(c) 75	75(a) 125
28	Seattle	75(b) 40	125	50	100(c) 75	75(a) 100
29	Syracuse	60	100(g) 75	100(g) 75	90(c) 75	80(a) 100
30	Washington	75(g) 50	110(g) 75	110(g) 75	75	110
31	Worcester, Mass.	60	125	75	100	100

(a) Where seats are fixed; (b) Public rooms exceeding 500 sq. ft. area; (c) Assembly rooms; (d) Occupied by less than 25 persons; (e) Sleeping accommodations for 20 or more persons; (f) First floor—Hotels, Tenements and Lodging Houses; (g) Rooms and spaces for public use or common use of tenants; (h) Tenement Houses and Hotels.

EXTRACTS FROM THE BUILDING LAWS OF VARIOUS CITIES.

Live Loads for Floors in Different Classes of Buildings, Exclusive of the Weight of the Materials of Construction.

(Revised to 1913.) **Pounds per Square Foot.**

Stables or Carriage Houses.	Garages.	Ord. Stores, Light Manufacturing, Light Storage.	Stores (Heavy Materials,) Warehouses, Factories.	Roofs. Slope <20°.	Roofs. Slope >20°.	Sidewalks.	No.
75	.....	120	150	40(i)	30(j)	200	1
100	.....	125	250(k) 175	40(i)	20(j)(l)	200	2
.....	.....	125	250	40(m)	.....	.....	3
40(n)	.....	120	150	40(j)	40(j)	.....	4
40(o) 100	40(o) 100	100	100	25(j)	25(j)	.....	5
75	.....	100	150	25(j)	25(j)	300	6
80	.....	125	200	40(i)	.....	200	7
.....	.....	.....	.....	.....	.....	.....	8
60(p) 80	60(p) 80	125(q) 130(r) 100	200(s) 175	40	40	250	9
.....	.....	125	125	50(i)	50(i)	.....	10
75	.....	120	150	50(i)	30(j)	300	11
.....	.....	150	150	20(v) 25(u) 40	20(v) 25(u) 40	.....	12
100	100	.....	150	40	30(j)	300	13
.....	.....	.....	.....	.....	.....	.....	14
85	100	100	.....	30(i)	30(i)	300	15
75	.....	120	150	50(i)	30(j)	300	16
.....	.....	120	150	40(i)	40(i)	.....	17
.....	.....	125	200	30(m)	.....	300	18
75	.....	120	150	50(i)	30(j)	300	19
.....	.....	120	150	30	30	.....	20
.....	.....	.....	250	50	50	.....	21
80	.....	125(q) 100	200	40	40	300	22
.....	.....	125	250	40(m)	.....	.....	23
50(n) 100	50(n) 100	100	200	40(j)	40(j)	.....	24
.....	.....	150	150	40	.....	.....	25
85	.....	100	200	30(j)	30(j)	300	26
75	.....	125	250	30(i)	20(j)	150	27
75	125	125	.....	40(j)	40(j)	.....	28
80	125	125	200	40	40	250	29
.....	.....	110	150	25(i)	25(i)	.....	30
75	.....	125	200	50(i)	30(j)	300	31

(i) Per square foot of surface; (j) Per square foot, measured horizontally; (k) Heavy storage; (l) Where used for public assembly or special purpose use same load as floors; (m) Flat; (n) Private; (o) Ground area less than 500 sq. ft.; (p) Small; (q) 1st floor; (r) Light storage and manufacturing; (s) Heavy Merchandise storage; (t) Hotel corridors; (u) Dwellings; (v) Sheds and outbuildings; (w) Building Laws in course of revision, 1913.

EXTRACTS FROM THE BUILDING LAWS OF VARIOUS CITIES.

ALLOWABLE UNIT STRESSES FOR STEEL AND IRON.

(Revised to 1913.) Pounds per Square Inch.

No.	City.	Tension.			
		Rolled Steel.	Cast Steel.	Wrought Iron.	Cast Iron.
1	Atlanta	16 000	16 000	12 000	3 000
2	Baltimore	16 000	16 000	12 000	5 000
3	Boston	16 000	16 000	12 000	.....
4	Buffalo	16 000	16 000	12 000	3 000
5	Chicago	16 000	16 000	12 000	.....
6	Cincinnati	16 000	16 000	12 000	3 000
7	Cleveland(f)	.....	.....	.....	.....
8	Denver(f)	.....	.....	.....	.....
9	Detroit	16 000(d)	16 000(d)	12 000	3 000
10	Hartford(f)	.....	.....	.....	.....
11	Jersey City	16 000	16 000	12 000	3 000
12	Los Angeles(e)	.....	.....	.....	.....
13	Louisville	16 000	16 000	12 000	.....
14	Milwaukee(f)	.....	.....	.....	.....
15	Minneapolis	16 000	16 000	12 000	3 000
16	Newark, N. J.	16 000	16 000	12 000	3 000
17	New Haven	16 000	.....	12 000	.....
18	New Orleans	16 000	16 000	12 000	.....
19	New York	16 000	16 000	12 000	3 000
20	Philadelphia	14 500(c) 16 250(d)	.....	12 500	.....
21	Pittsburgh(e)	.....	.....	.....	.....
22	Portland, Ore.	16 000	16 000	12 000	3 000
23	Providence(e)	.....	.....	.....	.....
24	Rochester	16 000	16 000	12 000	3 000
25	St. Louis(f)	.....	.....	.....	.....
26	St. Paul	16 000	16 000	12 000	3 000
27	San Francisco	16 000	16 000	12 000	.....
28	Seattle	16 000	16 000	12 000	.....
29	Syracuse	16 000	10 000(b) 16 000(a)	.....	3 000
30	Washington	16 000	16 000	12 000	3 000
31	Worcester, Mass.(e)	.....	.....	.....	.....

(a) Annealed; (b) Not annealed; (c) Mild Steel; (d) Medium Steel; (e)

EXTRACTS FROM THE BUILDING LAWS OF VARIOUS CITIES.

ALLOWABLE UNIT STRESSES FOR STEEL AND IRON.

(Revised to 1913.) **Pounds per Square Inch.**

Extreme Fibre Stress (Bending).								No.
Steel.			Wrought Iron.			Cast Iron.		
Rolled Beams.	Rolled Pins, Rivets and Bolts.	Riveted Beams Net Flange Section.	Rolled Beams.	Rolled Pins, Rivets and Bolts.	Riveted Beams Net Flange Section.	Compression Side.	Tension Side.	
16 000	20 000	14 000	12 000	15 000	12 000	16 000	3 000	1
16 000	20 000	15 000	.....	15 000	.....	16 000	5 000	2
16 000	22 500	.....	12 000	18 000	.....	16 000	3 000	3
16 000	.....	16 000	12 000	.....	12 000	13 000	.....	4
16 000	25 000	.....	12 000	.....	.....	10 000	3 000	5
16 000	24 000	16 000	12 000	.....	12 000	16 000	3 000	6
.....	.....	.....	.....	.....	.....	.....	.....	7
.....	.....	.....	.....	.....	.....	.....	.....	8
16 000	.....	16 000	12 000	.....	12 000	.....	.....	9
.....	.....	.....	.....	.....	.....	.....	.....	10
16 000	20 000	14 000	12 000	15 000	12 000	16 000	3 000	11
.....	.....	.....	.....	.....	.....	.....	.....	12
16 000	20 000	15 000	.....	15 000	.....	16 000	3 000	13
.....	.....	.....	.....	.....	.....	.....	.....	14
16 000	.....	16 000	12 000	.....	12 000	.....	.....	15
16 000	20 000	14 000	12 000	15 000	12 000	16 000	3 000	16
16 000	.....	16 000	12 000	.....	12 000	.....	.....	17
16 000	22 000	.....	12 000	18 000	.....	.....	.....	18
16 000	20 000	14 000	12 000	15 000	12 000	16 000	3 000	19
.....	.....	.....	.....	.....	.....	.....	.....	20
.....	.....	.....	.....	.....	.....	.....	.....	21
16 000	20 000	15 000	12 000	.....	12 000	16 000	3 000	22
.....	.....	.....	.....	.....	.....	.....	.....	23
16 000	20 000	14 000	12 000	15 000	12 000	16 000	3 000	24
.....	.....	.....	.....	.....	.....	.....	.....	25
16 000	20 000	14 000	12 000	15 000	12 000	16 000	3 000	26
16 000	.....	15 000	.....	.....	.....	.....	.....	27
16 000	24 000	16 000	12 000	.....	12 000	10 000	3 000	28
16 000	20 000	16 000	.....	.....	.....	16 000	2 500	29
16 000	20 000	14 000	12 000	15 000	12 000	16 000	3 000	30
.....	.....	.....	.....	.....	.....	.....	.....	31

Determined by the best modern practice; (f) Building Laws being revised, 1913.

EXTRACTS FROM THE BUILDING LAWS OF VARIOUS CITIES.

ALLOWABLE UNIT STRESSES FOR STEEL AND IRON.

(Revised to 1913.) **Pounds per Square Inch.**

No.	City.	Compression.					
		Rolled Steel.	Cast Steel.	Wrought Iron.	Cast Iron (in short blocks).	Steel Pins and Rivets — Bearing.	Wrought Iron Pins and Rivets — Bearing.
1	Atlanta	16 000	16 000	12 000	16 000	20 000	15 000
2	Baltimore	16 000	16 000	12 000	16 000	20 000	15 000
3	Boston	16 000	16 000	12 000	16 000	18 000	15 000
4	Buffalo	.....	.....	.....	15 000	15 000	15 000
5	Chicago	14 000(a)	14 000(a)	10 000(a)	10 000(a)	20 000(f) 25 000(s)	.....
6	Cincinnati	16 000	16 000	12 000	16 000	20 000	.....
7	Cleveland(l)	.....	.....	.....	.....	.....	.....
8	Denver(l)	.....	.....	.....	.....	.....	.....
9	Detroit	(b)	(b)	75% Steel	(b)	15 000(f) 20 000(s)	.....
10	Hartford(l)	.....	.....	.....	.....	.....	.....
11	Jersey City	16 000	16 000	12 000	16 000	20 000	15 000
12	Los Angeles(j)	.....	.....	.....	.....	.....	.....
13	Louisville	16 000	16 000	12 000	16 000	20 000	15 000
14	Milwaukee(l)	.....	.....	.....	.....	.....	.....
15	Minneapolis	16 000	16 000	12 000	16 000	18 000	15 000
16	Newark, N. J.	16 000	16 000	12 000	16 000	20 000	15 000
17	New Haven	16 000	.....	12 000	.....	20 000	15 000
18	New Orleans	16 000	.....	12 500	.....	18 000	15 000
19	New York	16 000	16 000	12 000	16 000	20 000	15 000
20	Philadelphia	14 500(c) 16 250(d)	.....	12 500	11 670	17 600(f) 22 000(s)	14 400(f) 18 000(s)
21	Pittsburgh(j)	.....	.....	.....	.....	.....	.....
22	Portland, Ore.	16 000	16 000	12 000	16 000	20 000	15 000
23	Providence(j)	.....	.....	.....	.....	.....	.....
24	Rochester	16 000	16 000	12 000	16 000	20 000	15 000
25	St. Louis(l)	.....	.....	.....	.....	.....	.....
26	St. Paul	16 000	16 000	12 000	16 000	20 000	15 000
27	San Francisco	16 000	16 000	12 000	.....	20 000	.....
28	Seattle	16 000	16 000	12 000	10 000(a)	20 000(f) 24 000(s)	.....
29	Syracuse	16 000	10 000(g) 16 000(e)	.....	10 000(g) 16 000	16 000(h) 20 000	.....
30	Washington	16 000	16 000	12 000	16 000	20 000	15 000
31	Worcester(j)	.....	.....	.....	.....	.....	.....

(a) Based on gross section; (b) Based on values given by standard steel manufacturer's handbook; (c) Mild steel; (d) Medium steel; (e) Annealed; (f) Field rivets; (g) Not annealed; (h) Field rivets driven by hand;

EXTRACTS FROM THE BUILDING LAWS OF VARIOUS CITIES.

ALLOWABLE UNIT STRESSES FOR STEEL AND IRON.

(Revised to 1913.) Pounds per Square Inch.

Shear.

Steel.				Wrought Iron.				Cast Iron.	No.
Web Plates.	Shop Rivets and Pins.	Field Rivets.	Field Bolts.	Web Plates.	Shop Rivets and Pins.	Field Rivets.	Field Bolts.		
9 000	10 000	8 000	7 000	6 000	7 500	6 000	5 500	3 000	1
9 000	10 000	8 000	7 000	6 000	7 500	6 000	5 500	3,000	2
10 000	10 000	10 000	8 000	9 000	9 000	9 000	7 200	.....	3
7 000	9 000	8 000	.....	6 000	7 500	6 000	.....	.....	4
10 000(a)	12 000	10 000	.....	.....	.....	.....	.....	2 000(i)	5
10 000	10 000	9 000	7 500	6 000	6 000	6 000	6 000	3 000	6
.....	.....	.....	.....	.....	.....	.....	.....	.....	7
.....	.....	.....	.....	.....	.....	.....	.....	.....	8
10 000	10 000	7 500	6 000	.....	.....	.....	.....	3 000	9
.....	.....	.....	.....	.....	.....	.....	.....	.....	10
9 000	10 000	10 000	7 000	6 000	7 500	6 000	5 500	3 000	11
.....	.....	.....	.....	.....	.....	.....	.....	.....	12
9 000	10 000	8 000	8 000	.....	7 500	6 000	5 000	2 500	13
.....	.....	.....	.....	.....	.....	.....	.....	.....	14
10 000	9 000	6 750	.....	6 000	7 500	6 000	.....	.....	15
9 000	10 000	8 000	7 000	6 000	7 500	6 000	5 500	3 000	16
10 000	10 000	8 000	.....	6 000	7 500	6 000	.....	.....	17
10 000	10 000	10 000	.....	9 000	9 000	9 000	.....	.....	18
9 000	10 000	8 000	7 000	6 000	7 500	6 000	5 500	3 000	19
8 750(c) / 10 000(d)	11 000	8 800	.....	7 500	9 000	7 200	.....	.....	20
.....	.....	.....	.....	.....	.....	.....	.....	.....	21
9 000	10 000	8 000	7 000	6 000	7 500	6 000	5 500	3 000	22
.....	.....	.....	.....	.....	.....	.....	.....	.....	23
9 000	10 000	8 000	7 000	6 000	7 500	6 000	5 500	3 000	24
.....	.....	.....	.....	.....	.....	.....	.....	.....	25
9 000	10 000	8 000	7 000	6 000	7 500	6 000	5 500	3 000	26
9 000	10 000	8 000	.....	7 000	.....	6 000	.....	.....	27
10 000(a)	12 000	10 000	.....	.....	.....	.....	.....	2 000(i)	28
10 000	10 000	8 000(h) / 10 000(k)	7 000	.....	.....	.....	.....	2 000	29
9 000	10 000	8 000	7 000	6 000	7 500	6 000	5 500	3 000	30
.....	.....	.....	.....	.....	.....	.....	.....	.....	31

(i) Brackets; (j) Based on best modern practice; (k) Power driven; (l) Building Laws being revised, 1913; (s) Shop rivets.

EXTRACTS FROM THE BUILDING LAWS OF VARIOUS CITIES.

ALLOWABLE UNIT STRESSES FOR STEEL AND IRON.

(Revised to 1913.) Pounds per Square Inch.

No.	City.	Columns.					
		Steel.		Cast Iron.		Wrought Iron.	
		Formula.	Max. Length L=	Formula.	Max. Length L=	Formula.	Max. Length L=
1	Atlanta.....	(A)	120 R	(B)	70 R	(C)	120 R
2	Baltimore...	Soft Steel (E) Medium " (F)	120 R	<50 R—10 000 > " (G)	60 R		
3	Boston.....	(H)	120 R	(B)	70 R	(I)	
4	Buffalo.....	<90 R-12 000 > " (J)	40 D	Round (M) Rectangular (N)	30 D	<90 R-8 000 > " (K)	40 D
5	Chicago.....	(O) 14 000 max.	120 R	(Q)	70 R	(P) 10 000 max.	
6	Cincinnati...	<70 R-13 000 > " (J)	180 R	Round (T) Rectangular (S) Others (U)	180 R		
7	Cleveland(e).	.....	.....	.....	.....	.....	.....
8	Denver(e)...	.....	.....	.....	.....	.....	.....
9	Detroit.....	<60 R-12 000 > " (O) (b)	44 D	Round (T)	30 D	75% Steel	.....
10	Hartford(e)..	.....	.....	.....	.....	.....	.....
11	Jersey City..	(A)	120 R	(B)	70 R	(C)	120 R
12	Los Angeles(d	.....	.....	.....	.....	.....	.....
13	Louisville....	<70 R-13 000 > " (CC)	120 R	Round (T) Rectangular (S) Others (U)	120 R	.....	.....
14	Milwaukee(e)	.....	.....	.....	.....	.....	.....
15	Minneapolis	(J)	40 D	Round (V) Rectangular (W)	30 D	(K)	40 D
16	Newark, N.J.	(A)	120 R	(B)	70 R	(C)	120 R

L = Length in inches; R = Radius of Gyration in inches; D = Diameter or Least Dimension in inches.

FORMULÆ:—

(A) $15\,200 - 58\frac{L}{R}$

(B) $11\,300 - 30\frac{L}{R}$

(C) $14\,000 - 80\frac{L}{R}$

(E) $\dfrac{14\,000}{1+\frac{L^2}{13\,500\,R^2}}$

(F) $\dfrac{15\,000}{1+\frac{L^2}{13\,500\,R^2}}$

(G) $\dfrac{11\,000}{1+\frac{L^2}{1\,000\,R^2}}$

(H) $\dfrac{16\,000}{1+\frac{L^2}{20\,000\,R^2}}$

(I) $\dfrac{12\,000}{1+\frac{L^2}{20\,000\,R^2}}$

(J) $17\,100 - 57\frac{L}{R}$

(K) $10\,600 - 30\frac{L}{R}$

(M) $\dfrac{14\,000}{1+\frac{L^2}{600\,D^2}}$

(N) $\dfrac{14\,000}{1+\frac{L^2}{850\,D^2}}$

(O) $16\,000 - 70\frac{L}{R}$

(P) $12\,000 - 60\frac{L}{R}$

(Q) $10\,000 - 60\frac{L}{R}$

(a) Must not exceed. (b) 85% for soft steel.

EXTRACTS FROM THE BUILDING LAWS OF VARIOUS CITIES.

ALLOWABLE UNIT STRESSES FOR STEEL AND IRON.

(Revised to 1913.) Pounds per Square Inch.

No.	City.	Columns.					
		Steel.		Cast Iron.		Wrought Iron.	
		Formula.	Max. Length L=	Formula.	Max. Length L=	Formula	Max. Length L=
17	New Haven..	12 500(c)	40 D / 120 R	13 330(c)	20 D	10 000(c)	40 D / 120 R
18	New Orleans.	(H)	.....	.....	.....	(I)	.....
19	New York...	(A)	120 R	(B)	70 R	(C)	120 R
20	Philadelphia.	Mild Steel (X) / Medium " (Y)	140 R	(Z)	20 D	(AA)	140 R
21	Pittsburgh(d)	.....	.....	.....	.....	.....	.....
22	Portland, Ore.	(A)	120 R	(B)	70 R	(C)	120 R
23	Providence..	.....	.....	.....	.....	.....	.....
24	Rochester...	(A)	120 R	(B)	70 R	(C)	120 R
25	St. Louis(e)..	.....	.....	.....	.....	.....	.....
26	St. Paul.....	(T)	.....	(T)	.....	.....	.....
27	San Francisco	<30 R–12 000 > " (DD)	120 R	Round (EE) / Rectangular (FF)	20 D	.....	.....
28	Seattle.....	(O) 14 000 max.	120 R	(Q)	70 R	(P)	.....
29	Syracuse....	(A)	120 R	(BB)	70 R	.....	.....
30	Washington..	(A)	120 R	(B)	70 R	(C)	120 R
31	Worcester(d).	.....	.....	.....	.....	.....	.....

L = Length in inches; R = Least Radius of Gyration in inches; D = Diameter or Least Dimension in inches.

FORMULÆ (continued):—

(S) $$\frac{10\,000}{1+\frac{L^2}{1\,067\,D^2}}$$

(T) $$\frac{10\,000}{1+\frac{L^2}{800\,D^2}}$$

(U) $$\frac{10\,000}{1+\frac{L^2}{6\,400\,R^2}}$$

(V) $$\frac{13\,330}{1+\frac{L^2}{400\,D^2}}$$

(W) $$\frac{13\,330}{1+\frac{L^2}{500\,D^2}}$$

(X) $$\frac{14\,500}{1+\frac{L^2}{13\,500\,R^2}}$$

(Y) $$\frac{16\,250}{1+\frac{L^2}{11\,000\,R^2}}$$

(Z) $$\frac{11\,670}{1+\frac{L^2}{400\,D^2}}$$

(AA) $$\frac{12\,500}{1+\frac{L^2}{15\,000\,R^2}}$$

(BB) $$9\,000-40\frac{L}{R}$$

(CC) $$17\,000-57\frac{L}{R}$$

(DD) $$15\,000-50\frac{L}{R}$$

(EE) $$\frac{8\,000}{1+\frac{L^2}{800\,D^2}}$$

(FF) $$\frac{8\,000}{1+\frac{L^2}{1\,067\,D^2}}$$

(c) Coefficients for use with Gordon's Formula. (d) Based on best modern practice. (e) Building Laws being revised, 1913.

EXTRACTS FROM THE BUILDING LAWS OF VARIOUS CITIES.

Allowable Unit Stresses for Masonry and Building Materials.
(Revised to 1913.) **Pounds per Square Inch.**

No.	City.	Compression.							
		Concrete.				Rubble Stonework.			
		Portland Cement 1:2:4	Portland Cement 1:2:5.	Rosendale Cement 1:2:4.	Rosendale Cement 1:2:5.	Portland Cement Mortar	Rosendale Cement Mortar.	Lime and Cement Mortar.	Lime Mortar.
1	Atlanta.....	230	208	125	111	140	111	97	70
2	Baltimore...	400	350	125	111	125	100	70	50
3	Boston.....	417	.....	.....	.....	.....	.....	.....	.....
4	Buffalo.....	56 (a)	56 (a)	.....	.....	70	.....	.....	.....
5	Chicago.....	400 (d) 350 (e)	350(d,f) 300 (e,f)	.....	150	200 (b) 100 (c)	.....	.....	120 (b) 60 (c)
6	Cincinnati...	208	208	.....	.....	167	125	.....	83
7	Cleveland(z).	.....	.....	.....	.....	.....	.....	.....	.....
8	Denver(z)...	.....	.....	.....	.....	.....	.....	.....	.....
9	Detroit.....	417	417	111	111	139	111	83 97 (g)	70
10	Hartford....	153	.....	.....	.....	.....	.....	.....	.....
11	Jersey City..	230	208	125	111	140	111	97	70
12	Los Angeles..	278 (a)	278 (a)	.....	.....	.....	.....	.....	.....
13	Louisville....	.....	.....	.....	.....	.....	167	.....	.....
14	Milwaukee..	400	250 (k) 300 (f)	.....	.....	175	125	.....	90
15	Minneapolis.	500 (i) 300	208 (h)	.....	.....	167	125	111	83
16	Newark, N. J.	230	208	125	111	140	111	97	70
17	New Haven..	208 (a)	208 (a)	.....	.....	.....	.....	.....	.....
18	New Orleans.	.....	.....	.....	.....	.....	.....	.....	.....
19	New York...	230	208	125	111	140	111	97	70
20	Philadelphia.	208	208	.....	.....	139	.....	111	70
21	Pittsburgh(j).	.....	.....	.....	.....	.....	.....	.....	.....
22	Portland,Ore.	.....	.....	.....	.....	208 (b) 167 (c)	.....	167 (b) 139 (c)	139 (b) 83 (c)
23	Providence..	222	195	111	83	139 (c) 153 (b)	125 (b) 97 (c)	97 (b) 70 (c)	83 (b) 56 (c)
24	Rochester...	230	208	125	111	140	111	97	70
25	St. Louis(z)..	.....	.....	.....	.....	.....	.....	.....	.....
26	St. Paul.....	500	400	125	111	200	100	125 (g)	80
27	San Francisco	277	277	.....	.....	.....	.....	.....	.....
28	Seattle.....	400	350 (f)	.....	.....	200 (b) 100 (c)	.....	.....	120 (b) 60 (c)
29	Syracuse....	400	300	100	80	110	.....	.....	.....
30	Washington..	400	320	125	111	140	111	97	70
31	Worcester(j).	.....	.....	.....	.....	.....	.....	.....	.....

(a) Foundations; (b) Coursed; (c) Ordinary; (d) Machine-mixed; (e) Hand-mixed; (f) 1:2½:5; (g) Portland Cement Mortar; (h) 1:3:5; (i) 500 where height is 12 diameters; 300 for 5 diameters or under; intermediate heights, intermediate values; (j) Based on best modern practice; (k) 1:3:6.

EXTRACTS FROM THE BUILDING LAWS OF VARIOUS CITIES.

Allowable Unit Stresses on Masonry and Building Materials.

(Revised to 1913.) **Pounds per Square Inch.**

Compression.

Brickwork.														No.
Portland Cem. Mortar 1:3.	Rosendale Cem. Mortar 1:3.	Lime and Cem. Mortar 1:1:6.	Lime Mortar 1:4.	Granites (per Test).	Greenwich Stone.	Gneiss.	Limestone (per Test).	Marble (per Test).	Sandstone (per Test).	Bluestone.	Hard Burned Brick, flatwise	Slate.		
250	208	160	111	1000–2400	....	1200	700–2300	600–1200	400–1600	2000	300	1000		1
250	208	160	111(l)	1000–2400	....	....	1000	1000–2000	400 n	1500 m	.....	....		2
278 q 250 r	250 q 208 r	167 q 139 r	111q p 97r p	833	....	....	556	556	417	....	.....	....		3
167	125 t 70 u	.....	83 t 42 u	.....	.....	.....	.....	.....	.....	.....	.....	....		4
350 v 175 u	150	125	100	.....	.....	.....	.....	.....	.....	.....	.....	....		5
250	167	.....	111	1000–2400	....	.....	.....	.....	400–1600	....	.....	....		6
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	....		7
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	....		8
208	.....	153 g 125	97	.....	.....	.....	.....	.....	.....	.....	.....	....		9
208	208	160	111	.....	.....	.....	.....	.....	.....	.....	.....	....		10
250	208	160	111	1000–2400	....	1200	700–2300	600–1200	400–1600	2000	300	1000		11
208	208	.....	111	.....	.....	.....	.....	.....	.....	.....	.....	....		12
250	167	.....	111	.....	.....	.....	.....	.....	.....	.....	.....	....		13
250	160	.....	120	.....	.....	.....	.....	.....	.....	.....	.....	....		14
208	.....	160	111	.....	.....	.....	.....	.....	.....	.....	.....	....		15
250	208	160	111	1000–2400	....	1200	700–2300	600–1200	400–1600	2000	300	1000		16
208	.....	160	111	.....	.....	.....	.....	.....	.....	.....	.....	....		17
250 q 167 u	.....	.....	125 q 83 u	830	....	....	550	550	415	....	.....	....		18
250	208	160	111	1000–2400	1200	1300	700–2300	600–1200	400–1600	2000	300	1000		19
208	.....	167	111	.....	.....	.....	.....	.....	.....	.....	.....	....		20
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	....		21
167 u 222 v	.....	139 u 167 v	111 u 139 v	.....	.....	.....	.....	.....	.....	.....	.....	....		22
181 u 222 v	139 u 167 v	111 u 139 v	83 u 111 v	.....	.....	.....	.....	.....	.....	.....	.....	....		23
250	208	160	111	1000–2400	1200	....	1300 w, x	600–1200	400–1600	....	300	1000		24
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	....		25
250	208	225 g	111	1000–2000	....	....	700–2300	600–1200	400–1600	....	150–300	....		26
208	208	139	97	389y	....	....	.....	.....	.....	.....	.....	....		27
175 v	.....	125 v	100	800y	....	....	400	.....	235–350	.....	.....	....		28
250	175	160 g	110	1000–2400	1200	1300	700–2300	600–1200	400–1600	2000	300	1000		29
250	.....	160	111	"	1200	1300	"	"	"	2000	.....	1000		30
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....		31

(l) Mortar 1 : 3; (m) Falls Road Stone; (n) Cement Stone; (o) Mortar 1 : 2; (p) Mortar 1 : 6; (q) Hard-burned Brick—first-class work; (r) Same—Ordinary work; (t) Hard-burned Brick; (u) Common Brick; (v) Higher values for special Brick; (w) Local; (x) Medina—2000; (y) Granite Masonry; (z) Building Laws being revised, 1913.

EXTRACTS FROM THE BUILDING LAWS OF VARIOUS CITIES.

Allowable Unit Stresses for Masonry, Etc.

(Revised to 1913.) Pounds per Square Inch.

No.	City.	Extreme Fibre Stress (Bending).					
		Granite.	Greenwich Stone.	Gneiss.	Limestone.	Slate.	Marble.
1	Atlanta	180	.....	150	150	400	120
2	Baltimore	180	150	.....	150	400	120
6	Cincinnati	50	.....	.....	.....	.....	.....
11	Jersey City	180	.....	150	150	400	120
14	Milwaukee	.....	.....	.....	.....	.....	.....
16	Newark, N. J.	180	.....	150	150	400	120
19	New York	180	150	150	150	400	120
24	Rochester	180	.....	.....	150(b)	400	120
26	St. Paul	180	.....	.....	150	.....	.....
29	Syracuse	180	150	150	150	400	120

Safe Bearing Capacity of Soils, Etc.
Tons per Square Foot.

No.	City.	Soft Clay.	Ordinary Clay and Sand, in Layers, Wet and Springy.	Loam, Clay or Fine Sand, Firm and Dry.	Very Firm Coarse Sand, Stiff Gravel or Hard Clay	Piers of Stone, Brick and Concrete in Caissons.		
						Carried down to Rock.	Carried down to Firm Gravel or Hard Clay.	Open Caissons or Sheet Pile Trenches, to Rock.
1	Atlanta	1	2	2–3	3–4	15	8–10	8
2	Baltimore	1	2	3	6(a) 4	20–24	12–18 (d)	.....
3	Boston	.....	.....	.....	.....	.....	.....	.....
4	Buffalo	.....	.....	.....	3½	.....	.....	.....
5	Chicago	.....	1½	1¾–2½	1¾–2½	.....	.....	.....
6	Cincinnati	1	1–2	4	8(c) 5	.....	.....	.....
9	Detroit	.....	2	3	4	.....	.....	.....
11	Jersey City	1	2	3	4	15	10	8
12	Los Angeles	1–3	1(e)	2–4	.....	.....	.....	.....
13	Louisville	.....	.....	2½	4	.....	.....	.....
15	Minneapolis	1	2	3	4	.....	.....	.....
16	Newark, N. J.	1	2	3	4	15	10	8
17	New Haven	.....	.....	.....	4(f)	.....	.....	.....
19	New York	1	2	3	4	15	10	8
20	Philadelphia	.....	.....	.....	6(c) 3½	.....	.....	.....
21	Pittsburgh	.....	.....	.....	.....	.....	.....	.....
22	Portland, Ore.	½(g) 1½	3	4	8(c)	.....	.....	.....
23	Providence	½(g) 1	2–3	2–5	4–10(c)	25–50 (h)	.....	10–15 (d)
24	Rochester	1	2	3	10(c) 6	15	10	8
26	St. Paul	1	2	3	6(a) 4	.....	.....	.....
27	San Francisco	1	2	3	6(a) 4	20(h)	.....	10(d)
28	Seattle	1	2	2½	8(c) 3½–5	.....	.....	.....
29	Syracuse	1	2	3	4	.....	.....	.....

(a) Coarse Gravel; (b) Local; (c) Well cemented; (d) Bearing—Hardpan or Hard Shale rock unexposed to air, frost and water; (e) Sandy loam; (f) Good, solid, natural earth; (g) Quicksand or alluvial soil; (h) Bearing—Very hard, native bed rock.

EXTRACTS FROM THE BUILDING LAWS OF VARIOUS CITIES.

Allowable Unit Stresses for Masonry, Etc.

(Revised to 1913.) Pounds per Square Inch.

Extreme Fibre Stress (Bending).								No.
Sand-stone.	Blue-stone.	Portland Concrete. 1 : 2 : 4.	Portland Concrete. 1 : 2 : 5.	Rosendale Concrete. 1 : 2 : 4.	Rosendale Concrete. 1 : 2 : 5.	Brick—Hardburned	Brickwork in Cement.	
100	300	30	20	16	10	50	30	1
100	.....	.....	.....	.....	.....	.....	.....	2
50	.....	.....	.....	.....	.....	.....	.....	6
100	300	30	20	16	10	50	30	11
.....	.....	35	25(k) 30(l)	.....	.....	.....	.....	14
100	300	30	20	16	10	50	30	16
100	300	30	20	16	10	50(i)	30	19
100(j)	300	30	20	16	10	50(i)	30	24
100	.....	30	20	16	10	50(i)	30	26
100	300	.....	.....	.....	.....	.....	.....	29

Allowable Safe Loads and Sizes for Wooden Piles.

Spacing		Minimum Diameter.			Safe Load—Tons.		Concrete Capping.		
Maximum C. to C. in inches.	Minimum C. to C. in inches.	Of Small End. Inches.	Of Butt. Lengths =<20ft. Inches.	Of Butt. Lengths >20 ft. Inches.	Formula for Single Pile.	Not to exceed per Pile	Thickness Rammed Between Heads. Inches.	Width Outside of Piles. Inches.	No.
36	20	5	10	12	(D)	20	12	12	1
.....	24	8(m) 6	10	10	.....	.....	12(n) 6	.....	2
36	.....	.....	.....	.....	.....	.....	16(n)	.....	3
36	24	6	12	12	.....	25	12	12	4
.....	.....	6	.....	.....	(D)&(S)	25	.....	.....	5
.....	.....	.....	.....	.....	.....	.....	.....	.....	6
.....	.....	5	10	12	(D)	25	10	12	9
.....	.....	.....	.....	.....	(D)	7–20	12	12	11
.....	.....	.....	.....	.....	.....	.....	.....	.....	12
36	20	5	10	12	(D)	20	.....	.....	13
36	20	5	10	12	(D)	20	12	12	15
36	20	5	10	12	(D)	7–20	12	12	16
36	.....	6	.....	.....	.....	20	12	12	17
36	20	5	10	12	(D)	20	.....	.....	19
30	.....	5	.....	.....	.....	20	12	12	20
.....	.....	.....	.....	.....	.....	20	.....	.....	21
.....	.....	6	12	12	(D)	25	6	12	22
36	24	.....	.....	.....	.....	12	12	12	23
36	20	5	10	12	(D)	20	12	12	24
.....	.....	5	10	12	(D)	25	9(n) 9	12	26
.....	12(o)	7	.....	.....	.....	25	12	.....	27
.....	24	6	12	12	(D)&(S)	25	6(n) 6	12	28
.....	.....	6	10	10	(D)	10–15	9	12	29

(i) Common; (j) Medina; (k) 1 : 3 : 6 mixture; (l) 1 : 2½ : 5 mixture; (m) Length = >20 ft.; (n) Capping, on top of heads; (o) In clear between piles: (D) For Drop Hammer, $\frac{2WH}{P+1}$ (S) For Steam Hammer, $\frac{2WH}{P+\frac{1}{10}}$ where W = Weight of hammer in Tons; H = Height of drop in Feet; P = Penetration of last blow (or average of last several blows) in Inches.

EXTRACTS FROM THE BUILDING LAWS OF VARIOUS CITIES.

ALLOWABLE UNIT STRESSES FOR TIMBER.

(Revised to 1913.) Pounds per Square Inch.

No.	City.	Compression.					
		Oak.		Yellow Pine.		White Pine.	
		With Grain.	Across Grain.	With Grain.	Across Grain.	With Grain.	Across Grain.
1	Atlanta	900	800	1000	600	800	400
2	Baltimore	1000	600	1000	600	800	400
3	Boston	810(e)	600(e)	900	500	630	250
4	Buffalo	800(c)	.....	1000	.....	700	.....
5	Chicago	900	500	1100(g, d) 800(f)	250(d)	700(c)	200(c)
6	Cincinnati	900	800	1000	600	800	400
7	Cleveland(q)	.....	.....	.....	.....	.....	.....
8	Denver(q)	.....	.....	.....	.....	.....	.....
9	Detroit	1000	.....	1250	.....	875	.....
10	Hartford(q)	.....	.....	.....	.....	.....	.....
11	Jersey City	900	800	1000	600	800	400
12	Los Angeles(a)	.....	.....	.....	.....	.....	.....
13	Louisville	1000	600	1000	600	800	400
14	Milwaukee	1500(e)	500(e)	1500(g) 1200(f)	350(g) 300(f)	1100(d)	200(d)
15	Minneapolis	800(e)	.....	1000(h)	.....	700	.....
16	Newark, N. J.	1100	800	1500	600	800	400
17	New Haven(a)	.....	.....	.....	.....	.....	.....
18	New Orleans	.....	.....	.....	400(f) 500(g)	.....	.....
19	New York	900	800	1000	600	800	400
20	Philadelphia	.....	.....	750	550	.....	.....
21	Pittsburgh(a)	.....	.....	.....	.....	.....	.....
22	Portland, Ore.	.....	.....	.....	.....	900(l)	200(l)
23	Providence(a)	.....	.....	.....	.....	.....	.....
24	Rochester	900	800	1000	600	800	400
25	St. Louis(q)	.....	.....	.....	.....	.....	.....
26	St. Paul	1000	700	1100(h)	600(h)	900	400
27	San Francisco	.....	.....	.....	.....	800(l)	200(l)
28	Seattle	.....	.....	.....	.....	.....	.....
29	Syracuse	900	800	800(f)(b) 1000(g)	400(f)(b) 600(g)	800	400
30	Washington	900	800	1000	600	800	400
31	Worcester(a)	.....	.....	.....	.....	.....	.....

(a) Based on best modern practice; (b) Applies also to North Carolina Pine; (c) Also for Norway Pine; (d) Also for Douglas Fir; (e) White Oak; (f) Shortleaf; (g) Longleaf; (h) Also for Washington or Oregon Fir; (i) Douglas or Yellow Fir only.

EXTRACTS FROM THE BUILDING LAWS OF VARIOUS CITIES.

ALLOWABLE UNIT STRESSES FOR TIMBER.

(Revised to 1913.) **Pounds per Square Inch.**

Compression.								No.
Spruce		Locust.		Hemlock.		Chestnut.		
With Grain	Across Grain	With Grain.	Across Grain.	With Grain.	Across Grain.	With Grain.	Across Grain.	
800	400	1200	1000	500	500	.....	.....	1
800(b)(k)	400(b)(k)	1200	1000	600	500	.....	.....	2
630	630	.....	.....	.....	.....	.....	.....	3
.....	.....	.....	.....	700	.....	.....	.....	4
.....	.....	.....	.....	500	150	.....	.....	5
800	400	1200	1000	500	500	500	1000	6
.....	.....	.....	.....	.....	.....	.....	.....	7
.....	.....	.....	.....	.....	.....	.....	.....	8
950(n)	.....	850(m)	.....	750	.....	.....	.....	9
.....	.....	.....	.....	.....	.....	.....	.....	10
800	400	1800	1000	500	500	500	1000	11
.....	.....	.....	.....	.....	.....	.....	.....	12
.....	.....	.....	.....	600	500	600	1000	13
{1100(o) 1000	{300(o) 200	1000(n)	250(n)	900	200	1100(m)	240(m)	14
800	.....	760(n)	.....	600	.....	.....	.....	15
800	400	1200	1000	600	500	500	1000	16
.....	.....	.....	.....	.....	.....	.....	.....	17
.....	200(m)	.....	.....	.....	.....	.....	.....	18
800	400	1200	1000	500	500	500	1000	19
500	300	.....	.....	350	250	.....	.....	20
.....	.....	.....	.....	.....	.....	.....	.....	21
1500(i)	400(i)	1200(j)	250(j)	.....	.....	.....	.....	22
.....	.....	.....	.....	.....	.....	.....	.....	23
800	400	1200	1000	500	500	500	1000	24
.....	.....	.....	.....	.....	.....	.....	.....	25
800	400	1200	1000	500	300	800	400	26
800	200	1600(i)	300(i)	900(j)	250(j)	.....	.....	27
800	300	1600(i)	400(i)	1400(p)	350(p)	.....	.....	28
800	400	.....	.....	600	300	.....	.....	29
800(k)	400(k)	1200	1000	.....	.....	500	1000	30
.....	.....	.....	.....	.....	.....	.....	.....	31

(j) Red Fir only; (k) Also for Virginia Pine; (l) Also for Redwood; (m) Cypress only; (n) Norway Pine only; (o) Cedar; (p) Western Hemlock; (q) Building Laws being revised, 1913.

EXTRACTS FROM THE BUILDING LAWS OF VARIOUS CITIES.

ALLOWABLE UNIT STRESSES FOR TIMBER.

(Revised to 1913.) **Pounds per Square Inch.**

No.	City.	Extreme Fibre Stress (Bending).						
		Yellow Pine.	White Pine.	Spruce.	Oak.	Locust.	Hemlock.	Chestnut.
1	Atlanta	1200	800	800	1000	1200	600	800
2	Baltimore	1800(l)	1000	1350(f)	1500	.....	1000	.....
3	Boston	1500(l)	1000	1000	1000(d)	.....	.....	.....
4	Buffalo	1800	1080(b)	.....	1350	.....	1080	.....
5	Chicago	1000(s) 1300(l, m)	800(b)	.....	1200	.....	600	.....
6	Cincinnati	1200	800	800	1000	1200	600	800
7	Cleveland(u)	.....	.....	.....	.....	.....	.....	.....
8	Denver(u)	.....	.....	.....	.....	.....	.....	.....
9	Detroit	1250	750	750	1000(d)	950(e)	.....	.....
10	Hartford(u)	.....	.....	.....	.....	.....	.....	.....
11	Jersey City	1200	800	800	1000	1200	600	800
12	Los Angeles	1620(c)	1260	1260	2160	.....	.....	.....
13	Louisville	1200	.....	.....	1000	.....	800	.....
14	Milwaukee	1500(s) 1800(l)	1200(e) 1000	1000	1500(d)	1300(h)	700	1100(p)
15	Minneapolis	1620(a)	1080(b)	.....	1350	.....	1080	.....
16	Newark, N. J.	1500	800	800	1100	1200	600	800
17	New Haven	1800	1080	1260	1350	.....	554	.....
18	New Orleans	1200(s) 1500(l)	.....	.....	.....	900(o)	.....	.....
19	New York	1200	800	800	1000	1200	600	800
20	Philadelphia	1600(l)	.....	1100	.....	.....	900	.....
21	Pittsburgh(k)	.....	.....	.....	.....	.....	.....	.....
22	Portland, Ore.	1600(h)	900	1000(i)	800(j)	.....	.....	.....
23	Providence(k)	.....	.....	.....	.....	.....	.....	.....
24	Rochester	1200	800	800	1000	1200	600	800
25	St. Louis(u)	.....	.....	.....	.....	.....	.....	.....
26	St. Paul	1200(a)	800	800	1000	1200	600	800
27	San Francisco	1200(h)	700	700	800(i)	750(j)	.....	.....
28	Seattle	1600(h)	.....	1000	.....	.....	1400(t)	.....
29	Syracuse	800(s)(g) 1200(l)	700	800	1200	.....	600	.....
30	Washington	1200	800(f)	800	1000	1200	.....	800
31	Worcester(k)	.....	.....	.....	.....	.....	.....	.....

(a) Also for Washington and Oregon Fir; (b) Also for Norway Pine; (c) Oregon Pine only; (d) White Oak; (e) Norway Pine only; (f) Also for Virginia Pine; (g) Also for North Carolina Pine; (h) Douglas Oregon Yellow Fir only; (i) Washington or Red Fir only; (j) Redwood only; (k) Based on best modern practice;

EXTRACTS FROM THE BUILDING LAWS OF VARIOUS CITIES.

ALLOWABLE UNIT STRESSES FOR TIMBER.

(Revised to 1913.) Pounds per Square Inch.

Tension.					No.
Yellow Pine.	White Pine.	Spruce.	Oak.	Hemlock.	
1200	800	800	1000	600	1
1800(l)	1000	1200(f)	1500	800	2
.....	.....	.....	.....	.....	3
.....	.....	.....	.....	.....	4
1000(s) 1300(l)(m)	800(b)	.....	1200	600	5
1200	800	800	1000	600	6
.....	.....	.....	.....	.....	7
.....	.....	.....	.....	.....	8
.....	.....	.....	.....	.....	9
.....	.....	.....	.....	.....	10
1200	800	800	1000	600	11
.....	.....	.....	.....	.....	12
1200	.....	.....	1000	.....	13
1000(s) 1200(l)	700(q)	800(m)(b)	1200(d)	600(r)	14
1200(a)	800	800	1000	.....	15
1200	800	800	1000	600	16
.....	.....	.....	.....	.....	17
.....	.....	.....	.....	.....	18
1200	800	800	1000	600	19
1600(l)	.....	1250	.....	1000	20
.....	.....	.....	.....	.....	21
1300(h)	800	1000(i)	.....	700(j)	22
.....	.....	.....	.....	.....	23
1200	800	800	1000	600	24
.....	.....	.....	.....	.....	25
1200(a)	800	800	1000	600	26
1200(h)	700	700	1000(i)	700(j)	27
1600(h)	.....	1000	.....	1400(t)	28
800(s) 1200(l)	800	800	1000	600	29
1200	800	800(f)	1000	.....	30
.....	.....	.....	.....	.....	31

(l) Longleaf; (m) Also for Douglas Fir; (n) Also for Chestnut; (o) Cypress only; (p) Cypress and Cedar only; (q) Also for Cedar; (r) Also Cypress; (s) Shortleaf; (t) Western Hemlock; (u) Building Laws being revised, 1913.

EXTRACTS FROM THE BUILDING LAWS OF VARIOUS CITIES.

ALLOWABLE UNIT STRESSES FOR TIMBER.

(Revised to 1913.) **Pounds per Square Inch.**

No.	City.	Shear.					
		Yellow Pine.		White Pine.		Spruce.	
		With Fibre.	Across Fibre.	With Fibre.	Across Fibre.	With Fibre.	Across Fibre.
1	Atlanta	70	500	40	250	50	320
2	Baltimore	100(l)	500(l)	85	350	90	350
3	Boston	100(l)	500(l)	80	250	80	250
4	Buffalo(r)	.....	.....	.....	.....	.....	.....
5	Chicago	120(s) 130(l)(c)	.....	80(d)	.....	.....	.....
6	Cincinnati	70	500	40	250	40	250
7	Cleveland(q)	.....	.....	.....	.....	.....	.....
8	Denver(q)	.....	.....	.....	.....	.....	.....
9	Detroit	100(l)	.....	80	.....	80	.....
10	Hartford(q)	.....	.....	.....	.....	.....	.....
11	Jersey City	70	500	40	250	50	320
12	Los Angeles(e)	.....	.....	.....	.....	.....	.....
13	Louisville	80	400	.....	.....	.....	.....
14	Milwaukee	150(s)(c) 175(l)	1000(s) 1250(l)	120(n) 100	500	125	750
15	Minneapolis(r)	.....	.....	.....	.....	.....	.....
16	Newark, N. J.	70	500	40	250	50	320
17	New Haven(e)	.....	.....	.....	.....	.....	.....
18	New Orleans	65(s) 70(l)	.....	50(f)	.....	.....	.....
19	New York	70	500	40	250	50	320
20	Philadelphia	100(l)	1125	.....	.....	75	750
21	Pittsburgh(e)	.....	.....	.....	.....	.....	.....
22	Portland, Ore.	150(g)	500(g)	100	500	100(h)	600(h)
23	Providence(e)	.....	.....	.....	.....	.....	.....
24	Rochester	70	500	40	250	50	320
25	St. Louis(q)	.....	.....	.....	.....	.....	.....
26	St. Paul	70(j)	500(j)	50	250	50	320
27	San Francisco	150(g)	750(g)	100	500	100	500
28	Seattle	150(g)	.....	.....	.....	100	.....
29	Syracuse	50(s) 70(l)	300(s) 500(l)	50	300	50	300
30	Washington	70	500	40	250	50(k)	320(k)
31	Worcester(e)	.....	.....	.....	.....	.....	.....

(a) Virginia Pine only; (b) White Oak; (c) Also for Douglas Fir; (d) Also for Norway Pine; (e) Based upon best modern practice; (f) Cypress only; (g) Douglas or Yellow Fir only; (h) Red Fir only;

EXTRACTS FROM THE BUILDING LAWS OF VARIOUS CITIES.

ALLOWABLE UNIT STRESSES FOR TIMBER.

(Revised to 1913.) Pounds per Square Inch.

Shear.							
Oak.		Locust		Hemlock.		Chestnut.	No.
With Fibre.	Across Fibre.	With Fibre.	Across Fibre.	With Fibre.	Across Fibre.	Across Fibre.	
100	600	100	720	40	275	150	1
100	720	90(a)	400(a)	75	350	150	2
150	600	.....	.....	.....	.....	.....	3
.....	.....	.....	.....	.....	.....	.....	4
200	.....	.....	.....	60	.....	.....	5
100	600	100	720	40	270	150	6
.....	.....	.....	.....	.....	.....	.....	7
.....	.....	.....	.....	.....	.....	.....	8
150(b)	.....	90)d)	.....	.....	.....	.....	9
.....	.....	.....	.....	.....	.....	.....	10
100	600	100	720	40	275	150	11
.....	.....	.....	.....	.....	.....	.....	12
80	400	.....	.....	.....	.....	.....	13
240(b)	1000(b)	100(m)	400(m)	100(o)	600	.....	14
.....	.....	.....	.....	.....	.....	.....	15
100	600	100	720	40	275	150	16
.....	.....	.....	.....	.....	.....	.....	17
.....	.....	.....	.....	.....	.....	.....	18
100	600	100	720	40	275	150	19
.....	.....	.....	.....	63	625	.....	20
.....	.....	.....	.....	.....	.....	.....	21
80(i)	400(i)	.....	.....	.....	.....	.....	22
.....	.....	.....	.....	.....	.....	.....	23
100	600	100	720	40	275	150	24
.....	.....	.....	.....	.....	.....	.....	25
100	600	100	720	40	275	150	26
125(h)	600(h)	100(i)	400(i)	.....	.....	.....	27
.....	.....	.....	.....	130(p)	.....	.....	28
100	600	.....	.....	35	250	.....	29
100	600	100	720	.....	.....	.....	30
.....	.....	.....	.....	.....	.....	.....	31

(i) Redwood only; (j) Also for Washington Fir; (k) Also for Virginia Pine; (l) Longleaf; (s) Shortleaf; (m) Cedar only; (n) Norway Pine only; (o) Also for Cypress; (p) Western Hemlock; (q) Building Laws being revised, 1913. (r) Do not specify.

EXTRACTS FROM THE BUILDING LAWS OF VARIOUS CITIES.

ALLOWABLE UNIT STRESSES FOR TIMBER.

(Revised to 1913.) Pounds per Square Inch.

No.	City.	Columns.					
		Longleaf Yellow Pine.	White Pine, Norway Pine and Spruce.	Oak.	Chestnut and Hemlock.	Locust.	Maximum Length L =
1	Atlanta.....	(A)	(B)	(I)	5/6 (B)	1½ (B)	30 D
2	Baltimore....	<12D (C) >" (E)	<12D (C) >" (E)	<12D (C) >" (E)	<12D (C) >" (E)	<12D (C) >" (E)	.....
3	Boston.....	(F)	(G)	(H)	.....	.....	30 D
4	Buffalo.....	<12D-1000 >" (F)	<12D-700 >" (J)(b)	<12D-800 >" (K)(a)	<12D-700 >" (J)(c)	.....	.....
5	Chicago.....	(M)	(M)	(M)	(M) (c)	.....	30 D
6	Cincinnati....	<12D-1000 >" (F)	<12D-700 >" (J)	<12D-800 >" (K)	.....	.....	180 R
7	Cleveland(m)	.....	.....	.....	.....	.....	.....
8	Denver(m)...	.....	.....	.....	.....	.....	.....
9	Detroit.....	<12D-1250 >" (F)	<10D-875 >" (J)(d)	<10D-1000 >" (K)(a)	.....	.....	24 D
10	Hartford(m)..	.....	.....	.....	.....	.....	.....
11	Jersey City...	(A)	(B)	(I)	5/6 (B)	1½ (B)	30 D
12	Los Angeles (l)	.....	.....	.....	.....	.....	.....
13	Louisville....	<12D-1000 >" (F)	.....	<12D-1000 >" (F)	.....	.....	120 R
14	Milwaukee...	<15D-1125 >" (T)(k)	<15D-825 i >" (T)(b)	<15D-1125 >" (T)	<15D-675 >" (T)(c)	<15D-750j >" (T)	30 D
15	Minneapolis..	<12D-1000 >" (F)(e)	<12D-700 >" (J)(b)	<12D-800 >" (K)(a)	<12D-600 >" (J)(c)	.....	.....
16	Newark, N. J.	(A)	(B)	(I)	5/6 (B)	1½ (B)	30 D

L = Length of column in inches; D = Diameter or least dimension of column in inches; R = Least radius of gyration in inches; C = Allowable compressive unit stress (with grain) for that wood.

(a) Also for Norway Pine; (b) White Pine only; (c) Hemlock only; (d) White Pine and Spruce only; (e) Also for Washington and Oregon Fir; (f) Spruce only; (g) Oregon Pine only; (h) White Pine and Virginia Pine only; (i) Also Douglas

FORMULÆ:—

(A) $1\,000 - 18\frac{L}{D}$

(B) $800 - 15\frac{L}{D}$

(E) $C - 125\frac{L}{12D}$

(F) $1\,000 - 10\frac{L}{D}$

(G) $700 - 7\frac{L}{D}$

(H) $900 - 9\frac{L}{D}$

(I) $900 - 17\frac{L}{D}$

(J) $625 - 6\frac{L}{D}$

EXTRACTS FROM THE BUILDING LAWS OF VARIOUS CITIES.

ALLOWABLE UNIT STRESSES FOR TIMBER.

(Revised to 1913.) **Pounds per Square Inch.**

No.	City.	Columns.					
		Longleaf Yellow Pine.	White Pine, Norway Pine and Spruce.	Oak.	Chestnut and Hemlock.	Locust.	Maximum Length L =
17	New Haven.....	1000 (N)	{700(b) 800(f) (N)	900 (N)	.....	.....	.....
18	New Orleans(n)..	.....	.....	.....	.....	.....	.....
19	New York.....	(A)	(B)	(I)	5/6 (B)	1½ (B)	30 D
20	Philadelphia....	(O)	(O)	(O)	(O)	(O)	.....
21	Pittsburgh(l)....	.....	.....	.....	.....	.....	.....
22	Portland, Ore....	(P)	(P)	(P)	(P)	(P)	20 D
23	Providence(l)....	.....	.....	.....	.....	.....	.....
24	Rochester.....	(A)	(B)	(I)	5/6 (B)	1½ (B)	30 D
25	St. Louis(m)....	.....	.....	.....	.....	.....	.....
26	St. Paul.....	(M)	(M)	(M)	(M)	(M)	.....
27	San Francisco...	<15D (Q)(g)	.....	.....	.....	.....	.....
28	Seattle.....	(P)	(P)	(P)	(P)	(P)	24 D
29	Syracuse.....	{¾(A)(s) (A)	(B)	(I)	(S) (c)	.....	30 D
30	Washington.....	(A)	(B)	(I)	.....	(A)	30 D
31	Worcester(l)....	.....	.....	.....	.....	.....	.....

L = Length of column in inches; D = Diameter or least dimension of column in inches; R = Least radius of gyration in inches; C = Allowable compressive unit stress (with grain) for that wood.

Fir, Cypress and Cedar; (j) For Norway Pine, Spruce and Eastern Fir only; (k) Shortleaf; (<15D = 900); (l) Based on best modern practice; (m) Building Laws being revised, 1913; (n) Does not specify; (s) Shortleaf.

(K) $750 - 7.5\frac{L}{D}$

(O) $C\ (1 - \frac{L}{100D})$

(S) $500 - 9\frac{L}{D}$

(M) $C\ (1 - \frac{L}{80D})$

(P) $C\ (1 - \frac{L}{70D})$

(T) $C\ (1 - \frac{L}{60D})$

(N) Coefficients to apply to Gordon's Formula.

(Q) $1300 - 20\frac{L}{D}$

EXTRACTS FROM THE BUILDING LAWS OF VARIOUS CITIES.

Allowable Unit Stresses for Reinforced Concrete.

(Revised to 1913.) **Pounds per Square Inch.**

No.	City.	Concrete Mixture.	Ratio Moduli of Elasticity Steel to Concrete.	Concrete—Allowable Unit Stresses.					
				Compression.			Shear.	Tension.	Bond.
				Direct.	Extreme Fibre Bending	In Hooped Columns			
1	Atlanta.....	1 : 2 : 4	12	600	800	.....	50	50	.....
2	Baltimore.....	1 : 2 : 4	15	500(b) 500	500	1200(ff)	50	.....	60
3	Boston.....	1 : 5 (h)	15	.....	500	.....	60	.....	60
4	Buffalo.....	1 : 2 : 5	12	350	500	.....	50	.....	50
5	Chicago.....	1 : 2 : 4	15	400	700	500 (l) 500(d)	40	40(w)	50(x) 70(y)
6	Cincinnati.....	1 : 2 : 4	15	600	700	(z)	65	.....	.....
7	Cleveland.....	1 : 2 : 4	15	500	700	650 (j)	40	40(w)	70 m 50
9	Detroit.....	1 : 1½ : 3t 1 : 2 : 4	15	450	650	(z) 800 (l)	40	.....	40
11	Jersey City....	1 : 2 : 4	18	350	500	(z)	50	.....	50
12	Los Angeles....	1 : 2 : 3	15	450	500	750	50	.....	50
13	Louisville.....	1 : 2 : 4	15	450(b) 650	650	650 d,l 540	50	.....	.....
14	Milwaukee....	1 : 2 : 4	15	500(b)	700	800(d) 600 600 (l)	120(n) 60 cc 40 bb	.....	40aa 80
15	Minneapolis...	1 : 2 : 4	10 15	600 dd	650	800ee 1830 ff	50	.....	100(q) 75(u)
16	Newark, N. J..	1 : 2 : 4	15	450 (b)	650	650(d) 540	40	.....	40
17	New Haven....	1 : 2 : 4	12	500	650	1000 (j)	50	.....	50
18	New Orleans...	.....	15	500 (r)	650 (r)	.....	50 (r)	.....	50
19	New York.....	1 : 6 (h)	15	500	650	725	40 150(n)	.....	80
20	Philadelphia...	1 : 2 : 4	30 c 15 s 12 r	150 (c) 300 (s) 500 (r)	250 (c) 400 (s) 600 (r)	1000(ff)	25(c) 50(s) 75(r)	.....	15(c) 40(s) 50(v)
22	Portland, Ore..	1 : 2 : 4	15	400	650	750 (l) 750 (j)	120(i) 40	.....	100(q) 70
24	Rochester.....	1 : 6 (h)	15	450(b) 650	650	540 (l) 650	60	.....	120(p) 80
26	St. Paul.....	1 : 2 : 4	15	500(b)	650	750(d)	50	.....	80(q) 50
27	San Francisco..	1 : 6 (h)	15	500	500	700	75	.....	60
28	Seattle.....	1 : 2 : 4	15	450	667	500 (j)	120(n) 60 cc	.....	50(x) 70(y)
29	Syracuse.....	1 : 2 : 4	15	500	225 (c) 650	(z) 800 (l)	40 (c) 120	40(w)	150(q) 80
30	Washington....	1 : 2 : 4	15	120(c) 400	150 (c) 650	.....	60	50	.....

(b) Columns not hooped; (c) Cinder concrete; (d) Vertical bars with hoops; (e) Actual compression in concrete surrounding steel; (f) Floor slabs; (g) Girders and beams; (h) Cement: aggregate; (i) Pure shear; (j) Spiral reinforcement; (k) Minimum area, gross section; (l) Structural steel units encasing concrete; (m) High carbon steel; (n) Where thoroughly reinforced for shear; (o) Without sign of crack; (p) Where adequate mechanical bond is provided; (q) Deformed bars; (r) Rock or gravel concrete; (s) Slag concrete;

EXTRACTS FROM THE BUILDING LAWS OF VARIOUS CITIES.

Allowable Unit Stresses for Reinforced Concrete.

(Revised to 1913.) **Pounds per Square Inch.**

Steel—Allowable Unit Stresses.				Columns.			Tests.		
Tension.	Compression.	Compression — Vertical Reinforcement in Columns	Shear.	Maximum Length / D	Minimum Allowable Dimension. Inches.	Actual less Effective Diam. — Inches.	Ratio Test to Calculated Load.	Ratio — Span to Maximum Deflection.	No.
16000	7500	6000	.....	14	.....	2	3	.....	1
12000 (v) 15000	8000 v 7500	.....	8000 v 10000	16	.....	3	.....	.....	2
16000	.....	.....	.....	.....	.....	3	.....	.....	3
16000	.....	.....	10000	16	.....	.....	3	.....	4
18000	10500	7500	12000	12	64 (k)	3	2	800	5
16000	16000	.....	10000	32 (z)	.....	2	4	.....	6
18000(m) 16000	16000(l)	9750(j) 7500	10000 w	15	.....	4	2½+ (o)	.....	7
18000m,q 16000	15 × (e)	(z) 12000 (l)	.....	15	10	4	2	400	9
16000	16000	6000	.....	12	.....	2	.....	.....	11
16000	.....	.....	10000	15	.....	3	.....	.....	12
16000	16000	.....	.....	15	.....	3	4	.....	13
16000	10500	12000(d) 7500(b)	.....	15	64 (k)	3	2 (o)	.....	14
20000(m) 16000	8000- 12000	8000 dd 10000 ee	10000	15	12	3	2	1000 (g) 300 (f)	15
20000(m) 16000	.....	8100(d) 6750(b)	.....	15	.....	4	.....	.....	16
16000	12 × (e)	.....	.....	16	.....	3	2 (o)	.....	17
16000	.....	.....	10000	.....	.....	.....	.....	.....	18
20000(aa) 16000	16000	6000 8700(d)	.....	15	12	4	2	.....	19
16000	7500 c 6000 s 7200 r	.....	10000	15	.....	4	2 (o)	.....	20
16000	.....	11250	.....	15	.....	4	1	800 (f)	22
20000(m) 16000	9750	9750(d) 6750(b)	.....	15	.....	3	.....	.....	24
20000(m) 16000	8000- 12000	7500(b) 10000(d)	10000	15	12	4	2	1000 (g) 300 (f)	26
20000	7500	8500	10000	15	10	4	2	700	27
18000	.....	7500(j) 6750	12000	15	8	2	2	700	28
20000(m) 16000	.....	.....	10000	15	.....	4	1½+	360	29
16000	14000	.....	10000	15	50 (k)	4	.....	.....	30

(t) For columns; (u) Bars ¾ inch or less; larger bars, proportionately less; (v) Soft steel; (w) Diagonal tension; (x) Flat bars with size ratio less than 2, and high carbon rounds and squares; (y) Structural steel rounds and squares; (z) For hooped columns, see Building Laws; (aa) Cold drawn material as wire; (bb) Horizontal bars; (cc) Bent up bars; (dd) Square columns; (ee) Round core columns; (ff) Special cases, see Building Laws.