List of Symbol Definitions

a long dimension for a section subjected to torsion (in, mm);
acceleration (ft/sec^2, m/sec^2);
width of the base of a retaining wall for pressure calculation (ft, m);
equivalent square column size in spread footing design (in, ft, mm, m);
distance used in beam formulas (ft, m);
depth of the effective compression block in a concrete beam (in, mm)

$\mathcal{a}$ area bounded by the centerline of a thin walled section subjected to torsion (in^2, mm^2)

A area, often cross-sectional (in^2, ft^2, mm^2, m^2)

A_b area of a bolt (in^2, mm^2)

A_e <u>effective</u> net area found from the product of the net area A_n by the shear lag factor U (in^2, ft^2, mm^2, m^2)

A_g gross area, equal to the total area ignoring any holes or reinforcement (in^2, ft^2, mm^2, m^2)

A_{gv} gross area subjected to shear for block shear rupture (in^2, ft^2, mm^2, m^2)

A_n net area, equal to the gross area subtracting any holes (in^2, ft^2, mm^2, m^2) *(see A_e)*

A_{net} net area, equal to the gross area subtracting any reinforcement (in^2, ft^2, mm^2, m^2)

A_{nt} net area subjected to tension for block shear rupture (in^2, ft^2, mm^2, m^2)

A_{nv} net area subjected to shear for block shear rupture (in^2, ft^2, mm^2, m^2)

A_p bearing area (in^2, ft^2, mm^2, m^2)

$A_{req'd}$ area required to satisfy allowable stress (in^2, ft^2, mm^2, m^2)

A_s area of steel reinforcement in concrete beam and masonry design (in^2, ft^2, mm^2, m^2)

A'_s area of steel compression reinforcement in concrete beam design (in^2, ft^2, mm^2, m^2)

A_{st} area of steel reinforcement in concrete and masonry column design (in^2, ft^2, mm^2, m^2)

A_{throat} area across the throat of a weld (in^2, ft^2, mm^2, m^2)

A_v area of concrete shear stirrup reinforcement (in^2, ft^2, mm^2, m^2)

A_{web} web area in a steel beam equal to the depth x web thickness (in^2, ft^2, mm^2, m^2)

A_1 area of column in spread footing design (in^2, ft^2, mm^2, m^2)

A_2 projected bearing area of column load in spread footing design (in^2, ft^2, mm^2, m^2)

ASD Allowable Stress Design

b width, often cross-sectional (in, ft, mm, m);
narrow dimension for a section subjected to torsion (in, mm);
number of truss members;
rectangular column dimension in concrete footing design (in, mm, m);
distance used in beam formulas (ft, m)

b_E effective width of the flange of a concrete T beam cross section (in, mm)

b_f width of the flange of a steel or concrete T beam cross section (in, mm)

b_o perimeter length for two-way shear in concrete footing design (in, ft, mm, m)

b_w width of the stem (web) of a concrete T beam cross section (in, mm)

B spread footing or retaining wall base dimension in concrete design (ft, m);
dimension of a steel base plate for concrete footing design (in, mm, m)

B_s width within the longer dimension of a rectangular spread footing that reinforcement must be concentrated within for concrete design (ft, m)

B_1 factor for determining M_u for combined bending and compression

c distance from the neutral axis to the top or bottom edge of a beam (in, mm, m);
distance from the center of a circular shape to the surface under torsional shear strain (in, mm, m);
rectangular column dimension in concrete footing design (in, mm, m);
the distance from the top of a masonry beam to the neutral axis

c_i distance from the center of a circular shape to the inner surface under torsional shear strain (in, mm, m)

c_o distance from the center of a circular shape to the outer surface under torsional shear strain (in, mm, m)

c_1 coefficient for shear stress for a rectangular bar in torsion

c_2 coefficient for shear twist for a rectangular bar in torsion

CL, ℄ center line

C compression label;
compression force (lb, kips, N, kN):
dimension of a steel base plate for concrete footing design (in, mm, m)

C_b modification factor for moment in ASD & LRFD steel beam design, $C_b = 1$ for simply supported beams (0 moments at the ends)

C_c column slenderness classification constant for steel column design;
compressive force in the concrete of a doubly reinforced concrete beam (lb, k, N, kN)

C_C curvature factor for laminated arch design

C_D load duration factor for wood design

C_f form factor for circular sections or or square sections loaded in plane of diagonal for wood design

C_{fu} flat use factor for other than decks in wood design

C_F size factor for wood design

C_H shear stress factor for wood design

C_i incising factor for wood design

C_L beam stability factor for wood design

C_m modification factor for combined stress in steel design;
compression force in the masonry for masonry design (lb, k, N, kN)

C_M wet service factor for wood design

C_p column stability factor for wood design

C_r repetitive member factor for wood design

C_v web shear coefficient for steel design

C_V volume factor for glue laminated timber design

C_s compressive force in the compression steel of a doubly reinforced concrete beam (lb, k, N, KN)

C_t temperature factor for wood design

d depth, often cross-sectional (in, mm, m);
diameter (in, mm, m);
perpendicular distance from a force to a point in a moment calculation (in, ft, mm, m);
effective depth from the top of a reinforced concrete or masonry beam to the centroid of the tensile steel (in, ft, mm, m):
critical cross section dimension of a rectangular timber column cross section related to the profile (axis) for buckling (in, mm, m);
symbol in calculus to represent a very small change (like the greek letters for d, *see* δ & Δ)

d' effective depth from the top of a reinforced concrete beam to the centroid of the compression steel (in, ft, mm, m)

d_b bar diameter of a reinforcing bar (in, mm)
nominal bolt diameter (in, mm)

d_f depth of a steel column flange (wide flange section) (in, mm)

d_x difference in the x direction between an area centroid ($\bar{x}$) and the centroid of the composite shape ($\hat{x}$) (in, mm)

d_y difference in the y direction between an area centroid ($\bar{y}$) and the centroid of the composite shape ($\hat{y}$) (in, mm)

D diameter of a circle (in, mm, m);
dead load for LRFD design

DL dead load

e eccentric distance of application of a force (P) from the centroid of a cross section (in, mm)

E modulus of elasticity (psi; ksi, kPa, MPa, GPa);
earthquake load for LRFD design

E_c modulus of elasticity of concrete (psi; ksi, kPa, MPa, GPa)

E_s modulus of elasticity of steel (psi; ksi, kPa, MPa, GPa)

f symbol for stress (psi, ksi, kPa, MPa)

f_a calculated axial stress (psi, ksi, kPa, MPa)

f_b calculated bending stress (psi, ksi, kPa, MPa)

f_c calculated compressive stress (psi, ksi, kPa, MPa)

f'_c concrete design compressive stress (psi, ksi, kPa, MPa)

f_{cr} calculated column stress based on the critical column load P_{cr} (psi, ksi, kPa, MPa)

f_m calculated compressive stress in masonry (psi, ksi, kPa, MPa)

f'_m masonry design compressive stress (psi, ksi, kPa, MPa)

f_p calculated bearing stress (psi, ksi, kPa, MPa)

f_s stress in the steel reinforcement for concrete or masonry design (psi, ksi, kPa, MPa)

f_s' compressive stress in the compression reinforcement for concrete beam design (psi, ksi, kPa, MPa)

f_t calculated tensile stress (psi, ksi, kPa, MPa)

f_v calculated shearing stress (psi, ksi, kPa, MPa)

f_x combined stress in the direction of the major axis of a column (psi, ksi, kPa, MPa)

f_y yield stress (psi, ksi, kPa, MPa)

F force (lb, kip, N, kN);
capacity of a nail in shear (lb, kip, N, kN);
symbol for allowable stress in design codes (psi, ksi, kPa, MPa);
fluid load for LRFD design

F_a allowable axial stress (psi, ksi, kPa, MPa)

F_b allowable bending stress (psi, ksi, kPa, MPa)

F_b' allowable bending stress for combined stress for wood design (psi, ksi, kPa, MPa)

F_c allowable compressive stress (psi, ksi, kPa, MPa)

$F_{c\perp}$ allowable compressive stress perpendicular to the wood grain (psi, ksi, kPa, MPa)

$F_{connector}$ resistance capacity of a connector (lb, kips, N, kN)

F_{cE} intermediate compressive stress for ASD wood column design dependant on material (psi, ksi, kPa, MPa)

F_{cr} flexural buckling (column) stress in ASD and LRFD (psi, ksi, kPa, MPa)

F_c' allowable compressive stress for ASD wood column design (psi, ksi, kPa, MPa)

F^*_c intermediate compressive stress for ASD wood column design dependant on load duration (psi, ksi, kPa, MPa)

F_e elastic critical buckling stress is steel design

F_{EXX} yield strength of weld material (psi, ksi, kPa, MPa)

$F_{horizontal\text{-}resist}$ resultant frictional force resisting sliding in a footing or retaining wall (lb, kip, N, kN)

F_n nominal strength in LRFD steel design (psi, ksi, kPa, MPa)
nominal tension or shear strength of a bolt (psi, ksi, kPa, MPa)

F_p allowable bearing stress parallel to the wood grain (psi, ksi, kPa, MPa)

F_s allowable tensile stress in reinforcement for masonry design (psi, ksi, kPa, MPa)

$F_{sliding}$ resultant force causing sliding in a footing or retaining wall (lb, kip, N, kN)

F_t allowable tensile stress (psi, ksi, kPa, MPa)

F_v allowable shear stress (psi, ksi, kPa, MPa);
allowable shear stress in a welded connection

F_x force component in the x coordinate direction (lb, kip, N, kN)

F_y force component in the y coordinate direction (lb, kip, N, kN);
yield stress (psi, ksi, kPa, MPa)

F_{yw} yield stress in the web of a steel wide flange section (psi, ksi, kPa, MPa)

F_u ultimate stress a material can sustain prior to failure (psi, ksi, kPa, MPa)

F.S. factor of safety

g acceleration due to gravity, 32.17 ft/sec^2, 9.807 m/sec^2;
gage spacing of staggered bolt holes (in, mm)

G shear modulus (psi; ksi, kPa, MPa, GPa);
gigaPascals (10^9 Pa or 1 kN/mm^2);
relative stiffness of columns to beams in a rigid connection *(see Ψ)*;
specific gravity (ie. factor multiplied by density of water to get density)

h depth, often cross-sectional (in, ft, mm, m);
height (in, ft, mm, m);
sag of a cable structure (ft, m);
effective height of a wall or column (*see* ℓ_e)

h_c height of the web of a wide flange steel section (in, ft, mm, m)

h_f depth of a flange in a T section (in, ft, mm, m);
height of a concrete spread footing (in, ft, mm, m)

H hydraulic soil load for LRFD design;
height of retaining wall (ft, m)

H_A horizontal force due to active soil pressure (lb, k, N, kN)

I moment of inertia (in^4, mm^4, m^4)

$\bar{I}$ moment of inertia about the centroid (in^4, mm^4, m^4)

I_c moment of inertia about the centroid (in^4, mm^4, m^4)

I_{min} minimum moment of inertia of I_x and I_y (in^4, mm^4, m^4)

$I_{transformed}$ moment of inertia of a multi-material section transformed to one material (in^4, mm^4, m^4)

I_x moment of inertia with respect to an x-axis (in^4, mm^4, m^4)

I_y moment of inertia with respect to a y-axis (in^4, mm^4, m^4)

j multiplier by effective depth of masonry section for moment arm, jd (*see d)*

J, J_o polar moment of inertia (in^4, mm^4, m^4)

k kips (1000 lb);
shape factor for plastic design of steel beams, M_p/M_y;
effective length factor for columns (*also K);*
distance from outer face of W flange to the web toe of fillet (in, mm);
multiplier by effective depth of masonry section for neutral axis, kd

kg kilograms

kN kiloNewtons (10^3 N)

kPa kiloPascals (10^3 Pa)

K effective length factor with respect to column end conditions *(also k)*;
masonry mortar strength designation

K_{cE} material factor for wood column design

ℓ length (in, ft, mm, m);
cable span (ft, m)

l_d development length for reinforcing steel (in, ft, mm, m) *(also L_d)*

l_{dc} development length for column dowels (in, ft, mm, m)

l_{dh} development length for hooks (in, ft, mm, m)

ℓ_e effective length that can buckle for wood column design (in, ft, mm, m) *(also L_e)*

l_n clear span from face of support to face of support in concrete design (in, ft, mm, m)

l_s lap splice length in concrete design (in, ft, mm, m)

lb pound force

L length (in, ft, mm, m);
live load for LRFD design;
spread footing dimension in concrete design (ft, m)

L_b unbraced length of a steel beam in LRFD design (in, ft, mm, m)

L_c clear distance between the edge of a hole and edge of next hole or edge of the connected steel plate in the direction of the load (in, ft, mm, m)

L_d development length of reinforcement in concrete (ft, m) *(also l_d)*

L_e effective length that can buckle for column design (in, ft, mm, m) *(also ℓ_e)*

L_m projected length for bending in concrete footing design (ft, m)

L_p maximum unbraced length of a steel beam in LRFD design for full plastic flexural strength (in, ft, mm, m)

L_r roof live load in LRFD design;
maximum unbraced length of a steel beam in LRFD design for inelastic lateral-torsional buckling (in, ft, mm, m)

L' length of an angle in a connector with staggered holes (in, mm);
length of the one-way shear area in concrete footing design (ft, m)

LL live load

LRFD Load and Resistance Factor Design

m mass (lb-mass, g, kg);
meters

mm millimeters

M moment of a force or couple (lb-ft, kip-ft, N-m, kN-m);
bending moment (lb-ft, kip-ft, N-m, kN-m);
masonry mortar strength designation

M_a required bending moment in steel ASD beam design (unified) (lb-ft, kip-ft, N-m, kN-m)

M_A moment value at quarter point of unbraced beam length for LRFD beam design (lb-ft, kip-ft, N-m, kN-m)

M_B moment value at half point of unbraced beam length for LRFD beam design (lb-ft, kip-ft, N-m, kN-m)

M_C moment value at three quarter point of unbraced beam length for LRFD beam design (lb-ft, kip-ft, N-m, kN-m)

M_m moment capacity of a reinforced masonry beam (lb-ft, kip-ft, N-m, kN-m)

M_n nominal flexure strength with the full section at the yield stress for LRFD steel beam design (lb-ft, kip-ft, N-m, kN-m);
nominal flexure strength with the steel reinforcement at the yield stress and compressive stress at the concrete design strength for reinforced beam design (lb-ft, kip-ft, N-m, kN-m)

$M_{overturning}$ resulting moment from all forces on a footing or retaining wall causing overturning (lb-ft, kip-ft, N-m, kN-m)

M_p (also M_{ult}) internal bending moment when all fibers in a cross section reach the yield stress (lb-ft, kip-ft, N-m, kN-m)

M_{resist} resulting moment from all forces on a footing or retaining wall resisting overturning (lb-ft, kip-ft, N-m, kN-m)

M_u maximum moment from factored loads for LRFD beam design (lb-ft, kip-ft, N-m, kN-m)

M_{ult} (also M_p) internal bending moment when all fibers in a cross section reach the yield stress (lb-ft, kip-ft, N-m, kN-m)

M_y internal bending moment when the extreme fibers in a cross section reach the yield stress (lb-ft, kip-ft, N-m, kN-m)

M_1 smaller end moment used to calculate C_m for combined stresses in a beam-column (lb-ft, kip-ft, N-m, kN-m)

M_2 larger end moment used to calculate C_m for combined stresses in a beam-column (lb-ft, kip-ft, N-m, kN-m)

MPa megaPascals (10^6 Pa or 1 N/mm^2)

n number of truss joints, nails or bolts;
modulus of elasticity transformation coefficient for steel to concrete or masonry

n.a. neutral axis (axis connecting beam cross-section centroids)

N Newtons (kg-m/sec^2);
bearing-type connection with bolt threads included in shear plane;
normal load (lb, kip, N, kN);
masonry mortar strength designation;
bearing length on a wide flange steel section (in, mm);
number of stories

o point of overturning of a retaining wall, commonly at the "toe"

o.c. on-center

O point of origin;
masonry mortar strength designation

p pitch of nail or bolt spacing (in, ft, mm, m);
pressure (lb/ft^2, kips/ft^2, N/m^2, Pa, MPa)

p_A active soil pressure (lb/ft^2, kips/ft^2, N/m^2, Pa, MPa)

P force, concentrated (point) load (lb, kip, N, kN);
axial load in a column or beam-column (lb, kip, N, kN)

P_a allowable axial load (lb, kip, N, kN);
required axial force in ASD steel design (unified) (lb, kip, N, kN)

$P_{allowable}$ allowable axial load (lb, kip, N, kN)

P_c available axial strength for steel unified design (lb, kip, N, kN)

P_{cr} critical (failure) load in column calculations (lb, kip, N, kN)

P_{dowels} nominal capacity of dowels from concrete column to footing in concrete design ((lb, kip, N, kN)

P_{e1} Euler buckling strength in steel unified design (lb, kip, N, kN)

P_n nominal column or bearing load capacity in LRFD steel and concrete design (lb, kip, N, kN);
nominal axial load for a tensile member or connection in LRFD steel (lb, kip, N, kN)

P_o maximum axial force with no concurrent bending moment in a reinforced concrete column (lb, kip, N, kN)

P_r required axial force in steel unified design (lb, kip, N, kN)

P_u factored column load calculated from load factors in LRFD steel and concrete design (lb, kip, N, kN);
factored axial load for a tensile member or connection in LRFD steel (lb, kip, N, kN)

Pa Pascals (N/m^2)

q shear flow (lb/in, kips/ft, N/m, kN/m);
soil bearing pressure (lb/ft^2, $kips/ft^2$, N/m^2, Pa, MPa)

$q_{allowed}$ allowable soil bearing pressure (lb/ft^2, $kips/ft^2$, N/m^2, Pa, MPa)

q_g gross allowed soil pressure (lb/ft^2, $kips/ft^2$, N/m^2, Pa, MPa)

q_{net} net allowed soil bearing pressure (lb/ft^2, $kips/ft^2$, N/m^2, Pa, MPa)

q_u ultimate soil bearing strength in allowable stress design (lb/ft^2, $kips/ft^2$, N/m, Pa, MPa);
factored soil bearing pressure in concrete design from load factors (lb/ft^2, $kips/ft^2$, N/m, Pa, MPa)

Q first moment area used in shearing stress calculations (in^3, mm^3, m^3):
generic axial load quantity for LRFD design *(also see R)*

$Q_{connected}$ first moment area used in shearing stress calculations for built-up beams (in^3, mm^3, m^3)

Q_x first moment area about an x axis (using y distances) (in^3, mm^3, m^3)

Q_y first moment area about an y axis (using x distances) (in^3, mm^3, m^3)

r radius of a circle or arc (in, mm, m);
radius of gyration (in, mm, m)

r_o polar radius of gyration (in, mm, m)

r_x radius of gyration with respect to an x-axis (in, mm, m)

r_y radius of gyration with respect to a y-axis(in, mm, m)

R force, reaction or resultant (lb, kip, N, kN);
radius of curvature of a beam (ft, m);
rainwater or ice load for LRFD design;
generic load quantity (force, shear, moment, etc.) for LRFD design *(also see Q)*;
radius of curvature of a laminated arch (ft, m)

R_a required strength (ASD-unified) *(also see* V_a*,* M_a*)*

R_n concrete beam design ratio = M_u/bd^2 (lb/in^2, MPa)
nominal value for LRFD design to be multiplied by ϕ *(also see* P_n*,* M_n*)*
nominal value for ASD design to be divided by the safety factor Ω

R_u design value for LRFD design based on load factors *(also see* P_u*,* M_u*)*

R_x reaction or resultant component in the x coordinate direction (lb, kip, N, kN)

R_y reaction or resultant component in the y coordinate direction (lb, kip, N, kN)

s length of a segment of a thin walled section (in, mm);
spacing of stirrups in reinforced concrete beams (in, mm);
longitudinal center-to-center spacing of any two consecutive holes (in, mm)

s.w. self-weight

S section modulus (in^3, mm^3, m^3);
snow load for LRFD design;
allowable strength per length of a weld for a given size (lb/in, kips/in, N/mm, kN/m);
masonry mortar strength designation

$S_{required}$ section modulus required to not exceed allowable bending stress (in^3, mm^3, m^3)

S_x section modulus with respect to the x-centroidal axis (in^3, mm^3, m^3)

S_y section modulus with respect to the y-centroidal axis (in^3, mm^3, m^3)

SC slip critical bolted connection

S4S surface-four-sided

t thickness (in, mm, m)

t_f thickness of the flange of a steel beam cross section (in, mm, m)

t_w thickness of the web of a steel beam cross section (in, mm, m)

T tension label;
tensile force (lb, kip, N, kN);
torque (lb-ft, k-ft, N-m, kN-m);
throat size of a weld (in, mm);
effect of thermal load for LRFD design;
period of vibration (sec)

T_s tension force in the steel reinforcement for masonry design (lb, kip, N, kN)

U shear lag factor for steel tension member design *(see* A_e *and* A_{net}*)*

U_{bs} reduction coefficient for block shear rupture

v shear force per unit length (lb/ft, k/ft, N/m, kN/m) *(see q)*

V volume (in^3, ft^3, mm^3, m^3);
shear force (lb, k, N, kN);
wind speed (mi/hr, m/hr)

V_a required shear in steel ASD design (unified) (lb, kip, N, kN)

V_c shear force capacity in concrete (lb, kip, N, kN)

V_n nominal shear strength capacity for LRFD beam design (lb, kip, N, kN)

V_s shear force capacity in steel shear stirrups(lb, kip, N, kN)

V_u maximum shear from factored loads for LRFD design (lb, kip, N, kN);
shear at a distance *d* away from the face of support for reinforced concrete beam design (lb, kip, N, kN)

V_{u1} maximum one-way shear from factored loads for LRFD beam design (lb, kip, N, kN)

V_{u2} maximum two-way shear from factored loads for LRFD beam design (lb, kip, N, kN)

w load per unit length on a beam (lb/ft, k/ft, N/m, kN/m) *(also* ω);
load per unit area (lb/ft^2, kips/ft^2, N/m^2, Pa, MPa);
width dimension (in, ft, mm, m)

$w_{adjusted}$ adjusted distributed load for equivalent live load deflection limit (lb/ft, kip/ft, N/m, kN/m)

w_c weight of reinforced concrete per unit volume (lb/ft^3, N/m^3)

$w_{equivalent}$ the equivalent distributed load derived from the maximum bending moment (lb/ft, kip/ft, N/m, kN/m)

w_u factored load per unit length on a beam from load factors (lb/ft, kip/ft, N/m, kN/m);
factored load per unit area on a surface from load factors (lb/ft^2, kip/ft^2, N/m^2, kN/m^2)

W weight (lb, kip, N, kN);
total load from a uniform distribution (lb, kip, N, kN);
wind load for LRFD design;
wide flange shape designation (i.e. W 21 x 68)

x a distance in the x direction (in, ft, mm, m);
the distance from the top of a concrete beam to the neutral axis

$\bar{x}$ the distance in the x direction from a reference axis to the centroid of a shape (in, mm)

$\hat{x}$ the distance in the x direction from a reference axis to the centroid of a composite shape (in, mm)

X bearing-type connection with bolt threads excluded from shear plane

y a distance in the y direction (in, ft, mm, m);
distance from the neutral axis to the y-level of a beam cross section (in, mm)

$\bar{y}$ the distance in the y direction from a reference axis to the centroid of a shape (in, mm)

$\hat{y}$ the distance in the y direction from a reference axis to the centroid of a composite shape (in, mm)

Z plastic section modulus of a steel beam (in^3, mm^3);
lateral design value for a single fastener in a timber connection (lb/nail, k/bolt)

Z_x plastic section modulus of a steel beam with respect to the x axis (in^3, mm^3)

' symbol for feet

" symbol for inches

symbol for pounds

= symbol for equal to

≈ symbol for approximately equal to

∝ symbol for proportional to

≤ symbol for less than or equal to

∫ symbol for integration

α	coefficient of thermal expansion (/°C, /°F); angle, in a math equation (degrees, radians)
β	angle, in a math equation (degrees, radians)
β_c	ratio of long side to short side of the column in concrete footing design
β_1	coefficient for determining stress block height, a, based on concrete strength, f'_c; coefficient for determining stress block height, c, in masonry LRFD design
δ	elongation (in, mm)
δ_P	elongation due to axial load (in, mm)
δ_s	shear deformation (in, mm)
δ_T	elongation due to change in temperature (in, mm)
Δ	beam deflection (in, mm); an increment
Δ_{LL}	beam deflection due to live load (in, mm)
Δ_{max}	maximum calculated beam deflection (in, mm)
Δ_{TL}	beam deflection due to total load (in, mm)
Δ_x	beam deflection in beam diagrams and formulas (in, mm)
ΔT	change in temperature (°C, °F)
ε	strain (no units)
ε_t	thermal strain (no units)
ε_y	yield strain (no units)
ϕ	diameter symbol; angle of twist (degrees, radians); resistance factor in LRFD steel design and reinforced concrete design
ϕ_b	resistance factor for flexure in LRFD design
ϕ_c	resistance factor for compression in LRFD design
ϕ_t	resistance factor for tension in LRFD design
ϕ_v	resistance factor for shear in LRFD design
μ	Poisson's ratio; coefficient of static friction
γ	specific gravity of a material (lb/in^3, lb/ft^3, N/m^3,kN/m^3); angle, in a math equation (degrees, radians); shearing strain; load factor in LRFD design
γ_D	dead load factor in LRFD design
γ_L	live load factor in LRFD design

θ angle, in a trig equation, ex. $\sin\theta$ (degrees, radians);
slope of the deflection of a beam at a point (degrees, radians)

π pi (180°)

ρ radial distance (in, mm);
radius of curvature in beam deflection relationships (ft, m);
reinforcement ratio in concrete beam design = A_s/bd

ρ_b balanced reinforcement ratio in masonry design

$\rho_{balanced}$ balanced reinforcement ratio in concrete beam design

ρ_g reinforcement ratio in concrete column design = A_{st}/A_g

ρ_{max} maximum reinforcement ratio allowed in concrete beam design for ductile behavior

σ engineering symbol for normal stress (axial or bending)

τ engineering symbol for shearing stress

υ_c shear strength in concrete design

ω load per unit length on a beam (lb/ft, kip/ft, N/m, kN/m) (*see w*);
load per unit area (lb/ft^2, kips/ft^2, N/m^2, Pa, MPa)

ω' load per unit volume (lb/ft, kip/ft, N/m, kN/m) (*see* γ)

Σ summation symbol

Ω safety factor for ASD of steel (unified)

Ψ relative stiffness of columns to beams in a rigid connection *(see G)*