Symbols List

A

a Clear width of wall between columns 5-39

a Equivalent width of infill strut, in. 7-25

α Factor equal to 0.5 for fixed-free cantilevered shear wall, or 1.0 for fixed-fixed pier 7-25

α Foundation shape correction factor 4-21

α Ratio of post-yield stiffness to effective stiffness 3-18

A Footing area; also cross-section area of pile 4-20

A_b Gross area of bolt or rivet, in.2 5-39

A_b Sum of net mortared area of bed joints above and below test unit, in.2 7-24

A_c Rivet area, in.2 5-39

A_e Effective net area, in.2 5-39

A_{es} Area of equivalent strut for masonry infill, in.2 7-24

A_f Flange area of member, in.2 5-39

A_g Gross area, in.2 5-39

A_n Area of net mortared/grouted section of wall or pier, in.2 7-24

A_{ni} Area of net mortared/grouted section of masonry infill, in.2 7-24

a_p Component amplification factor, related to rigidity of component that varies from 1.00 to 2.50 (select appropriate value from Table 11-2) 11-28

A_s Area of reinforcement, in.2 7-24

A_{st} Area of link stiffener, in.2 5-39

A_w Effective area of weld, in.2 5-39

B

B A coefficient used to adjust spectral response for the effect of viscous damping 2-46

B Width of footing 4-20

b Diaphragm width, ft 8-33

b The shortest plan dimension of the rehabilitated building, in ft (mm), measured perpendicular to d 9-27

b Width of compression element, in. 5-39

β Damping inherent in the building frame (typically equal to 0.05) 9-28

β Embedment factor 4-21

β Modal damping ratio 2-47

β Ratio of expected frame strength to expected infill strength 7-25

β_{b} Equivalent viscous damping of a bilinear system 9-28

b_{cf} Column flange width, in. 5-39

β_{D} Effective damping of the isolation system at the design displacement, as prescribed by Equation 9-18 9-28

B_{D1} Numerical coefficient taken equal to the value of b1 , as set forth in Table 2-15, at effective damping equal to the value of bD 9-26

β_{eff} Effective damping of isolator unit, as prescribed by Equation 9-13, or an energy dissipation unit, as prescribed by Equation 9-39; also used for the effective damping of the building, as p rescribed by Equations 9-26, 9-30, and 9-36 9-28

b_f Flange width, in. 5-39

β_M Effective damping of the isolation system at the maximum displacement, as prescribed by Equation 9-19 9-28

B_{M1} Numerical coefficient taken equal to the value of b1 , as set forth in Table 2-15, at effective damping equal to the value of bM 9-26

C

C or C_j Damping coefficient 9-26

χ A coefficient used to determine the out-of-plane forces required for anchorage of structural walls to diaphragms 2-47

c Cohesive strength of soil, expressed in force/unit area (pounds/ft2 or Pa) 4-20

c Fraction of strength loss for secondary elements as defined in Figure 7-1 7-25

C_0 Modification factor to relate spectral displacement and likely building roof displacement 3-17

C_1 Modification factor to relate expected maximum inelastic displacements to displacements calculated for linear elastic response 3-17

C_2 Modification factor to represent the effect of hysteresis shape on the maximum displacement response 3-17

C_3 Modification factor to represent increased displacements due to second-order effects 3-17

C_a Seismic coefficient at grade, equal to SDS/2.5, where SDS is defined in Section 2.15 11-28

C_b Coefficient to account for effect of non-uniform moment 5-39

CF_i State combination factors for use with velocity-dependent energy dissipation devices 9-26

C_t Numerical values follow Equation 3-3 3-17

C_{vx} Vertical distribution factor for the equivalent base shear 3-17

D

$\dot{D}$ Relative velocity of an energy dissipation unit 9-26

D Deflection of diaphragm or bracing element 8-33

D Depth of floor/roof horizontal diaphragm 8-33

D Depth of footing bearing surface 4-20

D Displacement of an energy dissipation unit 9-26

D Target spectral displacement 9-26

D'_D BSE-1 displacement, in in. (mm), at the center of rigidity of the isolation system in the direction under consideration, as prescribed by Equation 9-10 9-26

D'_M Maximum displacement, in in. (mm), at the center of rigidity of the isolation system in the direction under consideration, as prescribed by Equation 9-11 9-26

$D+$ Maximum positive displacement of an energy dissipation unit 9-26

$D-$ Maximum negative displacement of an energy dissipation unit 9-26

D_{ave} Average displacement of an energy dissipation unit, equal to (|D+| + |D-|)/2 9-26

$\overline{DCR}$ Average demand-capacity ratio for a story, computed in accordance with Equation 1-14 2-46

DCR Demand-capacity ratio, computed in accordance with Equation 1-13 or Equation 1-14 2-46

D_D Design displacement, in in. (mm), at the center of rigidity of the isolation system in the direction under consideration, as prescribed by Equation 9-2 9-26

D_M Maximum displacement, in in. (mm), at the center of rigidity of the isolation system in the direction under consideration, as prescribed by Equation 9-4 9-26

D_p Relative seismic displacement that the component must be designed to accommodate 11-28

D_r Drift ratio 11-28

D_{TD} Total design displacement, in in. (mm), of an element of the isolation system, including both translational displacement at the center of rigidity and the component of torsional displacement in the direction under consideration, as specified by Equation 9-6 9-26

D_{TM} Total maximum displacement, in in. (mm), of an element of the isolation system, including both translational displacement at the center of rigidity and the component of torsional displacement in the direction under consideration, as specified by Equation 9-7 9-26

d Depth to sample 4-20

d Overall depth of member, in. 5-39

d Short side of footing lateral contact area 4-20

d The longest plan dimension of the rehabilitated building, in ft (mm) 9-27

d Wall, pier, or infill inelastic drift percentage as defined in Figure 7-1 7-25

d_b Overall beam depth, in. 5-39

d_c Overall column depth, in. 5-39

d_i The depth of a layer of soils having similar properties, and located within 100 feet of the surface, in feet 2-47

d_v Bolt or rivet diameter, in. 5-40

d_v Length of component in direction of shear force, in. 7-25

d_w Depth of goundwater level 4-20

d_z Overall panel zone depth between continuity plates, in. 5-40

Δ Generalized deformation, unitless 5-40

$\Delta-$ Negative displacement amplitude, in in. (mm), of an isolator or energy dissipation unit during a cycle of prototype testing 9-27

$\Delta+$ Positive displacement amplitude, in in. (mm), of an isolator or energy dissipation unit during a cycle of prototype testing 9-27

Δ_{ave} Average displacement of an energy dissipation unit during a cycle of prototype testing, equal to (|D+| + |D-|)/2 9-27

Δ_d Diaphragm deformation 3-18

Δ_i Inter-story displacement (drift) of story i divided by the story height 5-40

$\Delta_{\iota 1}$ Estimated lateral deflection of building 1 relative to the ground at level i 2-47

$\Delta_{\iota 2}$ Estimated lateral deflection of building 2 relative to the ground at level i 2-47

Δ_{inf} Deflection of infill panel at mid-length when subjected to transverse loads, in. 7-25

$\Delta\pi$ Additional earth pressure on retaining wall due to seismic shaking 4-21

Δ_w Average in-plane wall displacement 3-18

Δ_y Generalized yield deformation, unitless 5-40

δ_c Pile compliance 4-21

δ_ι The lateral drift in story i, at its center of rigidity 2-47

δ_t Target roof displacement 3-18

δ_{xA} Deflection at building level x of Building A, determined by an elastic analysis as defined in Chapter 3 11-28

δ_{xB} Deflection at building level x of Building B, determined by an elastic analysis as defined in Chapter 3 11-28

δ_{yA} Deflection at building level y of Building A, determined by an elastic analysis as defined in Chapter 3 11-28

δ_y Yield displacement of building (Figure 3-1) 3-18

E

e Actual eccentricity, ft (mm), measured in plan between the center of mass of the structure above the isolation interface and the center of rigidity of the isolation system, plus accidental eccentricity, ft (mm), taken as 5% of the maximum building dimension perpendicular to the direction of force under consideration 9-27

e EBF link length, in. 5-40

e Wall, pier, or infill inelastic drift percentage as defined in Figure 7-1 7-25

E Modulus of elasticity of chord members 8-33

E Modulus of elasticity, 29,000 ksi 5-39

E Young's modulus 4-20

E_{fe} Expected elastic modulus of frame material, psi 7-24

E_{Loop} Energy dissipated, in kip-inches (kN-mm), in an isolator unit during a full cycle of reversible load over a test displacement range from D+ to D-, as measured by the area enclosed by the loop of the force-deflection curve 9-26

E_{me} Elastic modulus of masonry in compression as determined per Section 7.3.2.2, psi 7-24

e_n Nail deformation at yield load level 8-33

E_{se} Expected elastic modulus of reinforcing steel per Section 7.3.2.6, psi 7-24

F

ϕ A capacity reduction coefficient used to reduce the design strength of new components to account for variations in material strength, cross-section dimension and construction quality 2-47

ϕ Angle of internal friction, degrees 4-21

ϕ Resistance factor = 1.0 5-40

ϕ_i Modal displacement of floor i 9-28

ϕ_{rj} Relative modal displacement in horizontal direction of energy dissipation device j 9-28

F Force in an energy dissipation unit 9-26

$F-$ Negative force, in k, in an isolator or energy dissipation unit during a single cycle of prototype testing at a displacement amplitude of D- 9-26

f'_{dt} Lower bound of masonry diagonal tension strength, psi 7-25

f'_m Lower bound of masonry compressive strength, psi 7-25

f'_t Lower bound masonry tensile strength, psi 7-25

$F+$ Positive force, in k, in an isolator or energy dissipation unit during a single cycle of prototype testing at a displacement amplitude of D+ 9-26

F_1 and F_x Lateral load applied at floor levels i and x, respectively 3-17

f_1 Fundamental frequency of the building 9-27

fa Axial stress 8-33

F_a Factor to adjust spectral acceleration in the short period range for site class 2-46

f_a Lateral load per foot of diaphragm span 3-17

f_a Lower bound of vertical compressive stress, psi 7-25

F_a Total lateral load applied to a single bay of diaphragm 3-17

f_{ae} Expected vertical compressive stress, psi 7-25

fb Bending stress 8-33

F_{EXX} Classification strength of weld metal, ksi 5-39

f_{me} Expected masonry compressive strength of masonry as determined per Section 7.3.2.1, psi 7-25

F_p Seismic design force applied horizontally at the component's center of gravity and distributed relative to the component's mass distribution 11-28

F_{px} Diaphragm lateral force at floor level x 3-17

f_{te} Expected masonry tensile strength as determined per Section 7.3.2.3, psi 7-25

F_{te} Expected tensile strength, ksi 5-39

F_v Design shear strength of bolts or rivets, ksi 5-39

F_v Factor to adjust spectral acceleration at 1 second for site class 2-46

f_{vie} Expected shear strength of masonry infill, psi 7-25

f_y Lower bound of yield strength of reinforcing steel, psi 7-25

F_y Specified minimum yield stress of the type of steel being used, ksi 5-39

F_{yb} Fy of a beam, ksi 5-39

F_{yc} Fy of a column, ksi 5-39

f_{ye} Expected yield strength of reinforcing steel as determined per Section 7.3.2.6, psi 7-25

F_{ye} Expected yield strength, ksi 5-39

F_{yf} Fy of a flange, ksi 5-39

G

g Acceleration of gravity 3-17, 4-20

g Gravity constant (386.1 in/sec.2, or 9,800 mm/sec.2 for SI units) 9-27

G Modulus of rigidity of wood structural panel 8-33

G Shear modulus 4-20

G Shear modulus of steel, 11,200 ksi 5-39

G_d Modulus of rigidity of diaphragm 8-33

given in AISC (1994a) 5-39

G_{me} Shear modulus of masonry as determined per Section 7.3.2.5, psi 7-24

G_o Initial or maximum shear modulus 4-20

γ_t Total unit weight of soil 4-21

γ_w Unit weight of water 4-21

γ Unit weight or density, weight/unit volume (pounds/ft3 or N/m3) 4-21

H

h Average story height above and below a beam-column joint 5-40

h Average roof elevation of structure, relative to grade elevation 11-28

h Clear height of wall between beams 5-40

h Distance from inside of compression flange to inside of tension flange, inches 5-40 *h* Height of wall, in. 7-25

H Height of wall 8-33

H Horizontal load on footing 4-20

H *Thickness of a soil layer in feet* 2-46

H/L Aspect ratio 8-33

h_c Assumed web depth for stability, inches 5-40

h_{col} Height of column between beam centerlines, in. 7-25

h_{eff} Height to resultant of lateral force for wall or pier, in. 7-25

h_i and h_x Height from the base of a building to floor levels i and x, respectively 3-17

h_i The height of story i; this may be taken as the distance between the centerline of floor framing at each of the levels above and below, the distance between the top of floor slabs at each of the levels above and below, or similar common points of reference, in feet 2-47

h_{inf} Height of infill panel, in. 7-25

h_n Height to roof level, feet 3-17

H_{rw} Height of retaining wall 4-20

h_v Height of story v 5-40

h_v Shear buckling coefficient 5-40

η Displacement multiplier, greater than 1.0, to account for the effects of torsion 3-18

I

I Moment of inertia 4-20

I Moment of inertia of section, in.4 7-24

I_b Moment of inertia of beam, in.4 5-39

I_c Moment of inertia of column 5-39

I_{col} Moment of inertia of column section, in.4 7-24

I_f Moment of inertia of smallest frame member confining infill panel, in.4 7-24

J

J A coefficient used in linear analysis procedures to estimate the maximum earthquake forces that a component can sustain and correspondingly deliver to other components 2-46

J Modification factor to recognize that the framing system cannot likely deliver the force Q_E because of nonlinear response in the framing system 3-17

K

κ A reliability coefficient used to reduce component strength values for existing components based on the quality of knowledge about the component's properties 3-18

κ A reliability coefficient used to reduce component strength values for existing components based on the quality of knowledge about the components' properties. See Section 2.7.2. 2-47

κ Knowledge factor as defined in Section 1.7.2 7-26

κ Reduction factor to account for uncertainty of existing construction 5-40

k Exponent used for determining the vertical distribution of lateral forces 3-17

k Lateral stiffness of wall or pier, lb/in. 7-25

K' Storage stiffness 9-26

K'' Loss stiffness 9-26

K_{Dmax} Maximum effective stiffness, in k/in., of the isolation system at the design displacement in the horizontal direction under consideration, as prescribed by Equation 9-14 9-26

K_{Dmin} Minimum effective stiffness, in k/in., of the isolation system at the design displacement in the horizontal direction under consideration, as prescribed by Equation 9-15 9-26

K_e Effective stiffness of the building in the direction under consideration, for use with the Nonlinear Static Procedure 3-17

K_e Stiffness of a link beam, kip-inch 5-39

k_{eff} Effective stiffness of an isolator unit, as prescribed by Equation 9-12, or an energy dissipation unit, as prescribed by Equation 9-38 9-27

k_h Horizontal seismic coefficient in soil acting on retaining wall 4-20

K_i Elastic stiffness of the building in the direction under consideration, for use with the Nonlinear Static Procedure 3-17

K_L Passive pressure stiffness 4-20

K_{Mmax} Maximum effective stiffness, in k/in., of the isolation system at the maximum displacement in the horizontal direction under consideration, as prescribed by Equation 9-16 9-26

K_{Mmin} Minimum effective stiffness, in k/in., of the isolation system at the maximum displacement in the horizontal direction under consideration, as prescribed by Equation 9-17 9-26

k_o Stiffness coefficient for equivalent circular footing 4-20

$K\theta$ Rotational stiffness of a partially restrained connection, kip-inch/rad 5-39

K_s Rotational stiffness of a connection, kip-inch/rad 5-39

k_{sh} Winkler spring coefficient in horizontal direction, expressed as force/unit displacement/unit area 4-20

k_{sr} Winkler spring coefficient in overturning (rotation), expressed as force/unit displacement/unit area 4-20

k_{sv} Winkler spring coefficient in vertical direction, expressed as force/unit displacement/unit area 4-20

k_{vn} Axial stiffness of nth pile in a pile group 4-20

L

L Length of bracing member, inches 5-39

L Length of the column 10-15

L Length of footing in plan dimension 4-20

L Length of pile in vertical dimension 4-20

L Length of wall or floor/roof diaphragm 8-33

L Length of wall, in. 7-24

l Long side of footing lateral contact area 4-20

L/D Diaphragm ratio 8-33

l_b Length of beam 5-40

l_{beff} Assumed distance to infill strut reaction point for beams as shown in Figure C7-5, in. 7-25

l_c Length of column 5-40

l_{ceff} Assumed distance to infill strut reaction point for columns as shown in Figure C7-4, in. 7-25

L_d Single-bay diaphragm span 3-17

LDP Linear Dynamic Procedure—a method of lateral response analysis 2-46

L_{inf} Length of infill panel, in. 7-25

L_p The limiting unbraced length between points of lateral restraint for the full plastic moment capacity to be effective (see AISC, 1994a) 5-39

L_r The limiting unbraced length between points of lateral support beyond which elastic lateral torsional buckling of the beam is the failure mode (see AISC, 1994a) 5-39

LSP Linear Static Procedure—a method of lateral response analysis 2-46

λ Shape factor for lateral stiffness 4-21

λ Slenderness parameter 5-40

λ_1 Coefficient used to determine equivalent width of infill strut 7-26

λ_2 Infill slenderness factor 7-26

λ_p Limiting slenderness parameter for compact element 5-40

λ_r Limiting slenderness parameter for noncompact element 5-40

M

m A modification factor used in the acceptance criteria of deformation-controlled components or elements related to the available ductility of a component action 2-47

m Component demand modifier 3-17

m Ductility factor values used for Life Safety and Collapse Prevention performance goals 5-40

m Factor by which ultimate foundation capacity is multiplied for checking imposed foundation loads in Linear Static or Dynamic Analysis 4-20

m Mass (k-sec2/in.) 9-27

M Moment expected in the column at maximum expected drift 10-15

M Moment on footing 4-20

M/V Ratio of expected moment to shear acting on wall or pier 7-25

M_c Ultimate moment capacity of footing 4-20

M_{CE} Expected flexural strength of a member or joint, kip-in. 5-39

M_{CEx} Expected bending strength of a member about the x-axis, kip-in. 5-39

M_{CEy} Expected bending strength of a member about y-axis, kip-in. 5-39

m_e Effective m 5-40

M_p Plastic bending moment, kip-in. 5-39

M_x Bending moment in a member for the x-axis, kip-in. 5-39

m_x Value of m about x-axis of a member 5-40

M_y Bending moment in a member for the y-axis, kip-in. 5-39

m_y Value of m about y-axis of a member 5-40

N

$(N_1)_{60}$ Standard Penetration Test blow count normalized for an effective stress of 1 ton per square foot and corrected to an equivalent hammer energy efficiency of 60% 4-20

N Blow count in soil obtained from a standard penetration test (SPT) 2-46

N Number of piles in a pile group 4-20

$\overline{N}$ The average blow count in soil within the upper 100 feet of soil, calculated in accordance with Equation 1-6 2-46

N_b Number of bolts or rivets 5-39

NDP Nonlinear Dynamic Procedure—a method of lateral response analysis 2-46

NSP Nonlinear Static Procedure—a method of lateral response analysis 2-46

ν Poisson’s ratio 4-21

P

P Axial force in a member, kips 5-39

P Vertical load on footing 4-20

P^*_u Required axial strength of a column or a link, kips 5-39

P_c Lower bound of vertical compressive strength for wall or pier, pounds 7-25

P_{CE} Expected vertical axial compressive force per load combinations in Equations 3-14 and 3-15, pounds 7-25

P_{CL} Lower bound of vertical compressive force per load combination of Equation , pounds 7-25

P_{CL} Nominal axial strength of column, kips 5-39

P_{cr} Critical compression strength of bracing, kips 5-39

p_{D+L} Expected gravity stress at test location, psi 7-25

P_{E50} Probability of exceedance in 50 years 2-46

PI Plasticity Index for soil, determined as the difference in water content of soil at the liquid limit and plastic limit 2-46

P_i The total weight of the structure including dead, permanent live, and 25% of transient live loads acting on the columns and bearing walls within story level i 2-46

P_R Mean return period 2-46

PR Partially restrained 5-39

P_{uc} Required axial strength of a column based on Equations 3-6 and 3-2, kips 5-39

P_{ye} Expected yield axial strength of a member = Fye Ag , kips 5-39

Q

θ Angle between infill diagonal and horizontal axis, tan q = Linf /hinf, radians 7-26

θ Generalized deformation, radians 5-40

θ Stability coefficient (Equation 2-15)—a parameter indicative of the stability of a structure under gravity loads and earthquake-induced deflection 3-18

θ_b Angle between lower edge of compressive strut and beam as shown in Figure C7-5, radians 7-26

θ_c Angle between lower edge of compressive strut and beam as shown in Figure C7-4, radians 7-26

θ_ι A parameter indicative of the stability of a structure under gravity loads and earthquake-induced lateral deflection 2-47

θ_i Inter-story drift ratio, radians 5-40

θ_j Angle of inclination of energy dissipation device 9-28

θ_y Generalized yield deformation, radians 5-40

q Coefficient, less than one, equal to the ratio of actual hysteresis loop area to idealized bilinear hysteresis loop area 9-27

q Vertical bearing pressure 4-20

Q_c Ultimate bearing capacity 4-20

q_c Ultimate bearing capacity 4-20

Q_{CE} Expected strength of a component or element action at the deformation level under consideration. See Tables 1-17 and 1-18. 3-17

Q_{CE} Expected strength of component for use in Equation 3-17 7-25

Q_{CE} Required component capacity for Equation 3-17 5-39

Q_{CE} Strength capcity for deformation-controlled component actions 2-46

Q_{CL} Lower bound strength of component for use in Equation 3-18 7-25

Q_{CL} Lower-bound estimate of the strength of a component or element action at the deformation level under consideration. See Tables 1-17 and 1-18. 3-17

Q_{CL} Required component capacity for Equation 3-18 5-39

Q_{CL} The strength capacity for force-controlled component actions (see Section 1.13.3) 2-46

Q_D Dead (static) load 4-20

Q_D Dead load force (action) 3-17

Q_D The calculated stress resultant in a component due to dead load effects 2-46

Q_E Earthquake force (action) 3-17

Q_E Earthquake load 4-20

Q_E The calculated earthquake stress resultant in a component 2-46

Q_E Unreduced earthquake demand forces used in Equation 3-14 7-25

Q_G Gravity force acting on component as defined in Section 3.2.8 7-25

Q_G Gravity load force (action) 3-17

Q_G The calculated stress resultant in a component due to combined gravity loads, including dead, live, and snow, as applicable 2-46

q_{ine} Expected transverse strength of an infill panel, psf 7-25

Q_L Effective live load force (action) 3-17

Q_L Live (frequently applied) load 4-20

Q_L The calculated stress resultant in a component due to 25% of design live load effects 2-46

Q_S Effective snow load force (action) 3-17

Q_S Snow load 4-20

Q_{UD} Deformation-controlled design action 3-17

Q_{UP} Force-controlled design action 3-17

R

r Governing radius of gyration, in. 5-40

R Radius of equivalent circular footing 4-20

R Ratio of the elastic strength demand to the yield strength coefficient 3-17

r_{inf} Diagonal length of infill panel, in. 7-25

R_p Component response modification factor, related to ductility of anchorage that varies from 1.25 to 6.0 (select appropriate value from Table 11-2) 11-28

r_y Radius of gyration about y axis, in. 5-40

ρ Ratio of required axial force (Pu) to nominal shear strength (Vy) of a link 5-40

ρ Soil mass density 4-21

ρ_{g} Area of total vertical wall or pier reinforcement to area of net mortared/grouted section 7-26

ρ_{lp} Yield deformation of a link beam 5-40

S

σ Standard deviation of the variation of the material strengths 2-47

$\sigma Э_{\mathrm{o}}$ Effective vertical stress 4-21

S'_{D1} Design spectral response acceleration at a one-second period for damping other than 5%, g 2-46

S'_{DS} Design spectral response acceleration at short periods for damping other than 5%, g 2-47

S_1 Spectral response acceleration at a one-second period, obtained from response acceleration maps, g 2-46

S_a Response spectrum acceleration at the fundamental period and damping ratio of the building 3-17

S_a Spectral acceleration, g 2-46

S_{aD} Design BSE-1 spectral response acceleration at any period T, g 2-46

S_{aM} Design BSE-2 spectral response acceleration at any period T, g 2-46

S_{D1} 1-second, 5%-damped spectral acceleration, as set forth in Chapter 1 for the BSE-1 9-26

S_{D1} Design spectral response acceleration at a one-second period for 5% damping, g 2-46

S_{D1A} Design BSE-1 spectral response acceleration at a one-second period, g 2-47

S_{D1M} Design BSE-2 spectral response acceleration at a one-second period, g 2-47

S_{DS} Design spectral response acceleration at short periods for 5% damping, g 2-47, 4-20

S_{DS} Short-period, 5%-damped spectral acceleration, as set forth in Chapter 1 for the BSE-1 9-27

S_{DS} Spectral acceleration at 0.3 second, g (Section 1.6.1.4) 3-17

S_{DSM} Design BSE-2 spectral response acceleration at short periods, g 2-47

s_i Horizontal distance between adjacent buildings at the height above ground at which pounding may occur 2-47

S_{M1} 1-second, 5%-damped spectral acceleration, as set forth in Chapter 1 for the BSE-2 9-27

S_{MS} Short-period, 5%-damped spectral acceleration, as set forth in Chapter 1 for the BSE-2 9-27

S_n Distance between nth pile and axis of rotation of a pile group 4-20

SRM Simplified Rehabilitation Method 10-15

S_S Spectral response acceleration at short periods obtained from response acceleration maps, g 2-47

S_S Spectral response acceleration, g, at short periods obtained from response acceleration maps 4-20

S_{SD} Design BSE-1 spectral response acceleration at short periods, g 2-47

$\bar{s}_u$ The average value of the undrained soil shear strength in the upper 100 feet of soil, calculated in accordance with Equation 2-6, pounds/ft2 2-47

s_u Undrained shear strength of soil, pounds/ft2 2-47

ΣE_{Δ} Total energy dissipated, in in.-k, in the isolation system during a full cycle of response at the design displacement, DD 9-27

ΣE_M Total energy dissipated, in in.-k, in the isolation system during a full cycle of response at the maximum displacement, DM 9-27

$\Sigma F+_{Dmax}$ Sum, for all isolator units, of the maximum absolute value of force, in in.-k, at a positive displacement equal to DD 9-27

$\Sigma F+_{Dmin}$ Sum, for all isolator units, of the minimum absolute value of force, k, at a positive displacement equal to DD 9-28

$\Sigma F+_{Mmax}$ Sum, for all isolator units, of the maximum absolute value of force, k, at a positive displacement equal to DM 9-28

$\Sigma F+_{Mmin}$ Sum, for all isolator units, of the minimum absolute value of force, k, at a positive displacement equal to DM 9-28

$\Sigma F-_{Dmax}$ Sum, for all isolator units, of the maximum absolute value of force, k, at a negative displacement equal to DD 9-28

$\Sigma F-_{Dmin}$ Sum, for all isolator units, of the minimum absolute value of force, k, at a negative displacement equal to DD 9-28

$\Sigma F-_{Mmax}$ Sum, for all isolator units, of the maximum absolute value of force, k, at a negative displacement equal to DM 9-28

$\Sigma F-_{Mmin}$ Sum, for all isolator units, of the minimum absolute value of force, k, at a negative displacement equal to DM 9-28

T

T Fundamental period of the building in the direction under consideration 2-47, 3-17

t Thickness of link stiffener, in. 5-40

t Wall, pier or infill thickness, in. 7-25

T_0 Period at which the constant acceleration and constant velocity regions of the design spectrum intersect 2-47, 3-17

t_a Thickness of angle, in. 5-40

t_{bf} Thickness of beam flange, in. 5-40

t_{cf} Thickness of column flange, in. 5-40

T_D Effective period, in seconds, of the seismic-isolated structure at the design displacement in the direction under consideration, as prescribed by Equation 9-3 9-27

T_e Effective fundamental period of the building in the direction under consideration, for use with the Nonlinear Static Procedure 3-17

T_e Effective fundamental-mode period, in seconds, of the building in the direction under consideration 9-27

t_f Thickness of flange, in. 5-40

T_i Elastic fundamental period of the building in the direction under consideration, for use with the Nonlinear Static Procedure 3-17

t_{inf} Thickness of infill panel, in. 7-25

T_M Effective period, in seconds, of the seismic-isolated structure at the maximum displacement in the direction under consideration, as prescribed by Equation 9-5 9-27

t_p Thickness of flange plate, in. 5-40

t_p Thickness of panel zone including doubler plates, in. 5-40

T_s Secant fundamental period of a rehabilitated calculated using Equation 3-10 but replacing the effective stiffness (Ke) with the secant stiffness (Ks) at the target displacement 9-27

t_w Thickness of plate wall 5-40

t_w Thickness of web, in. 5-40

t_z Thickness of panel zone (doubler plates not necessarily included), in. 5-40

V

V Equivalent base shear 3-17

V Shear to element or component 8-33

v Shear per foot 8-33

v'_s Shear wave velocity at high strain 4-21

V^* Modified equivalent base shear 9-27

V_b The total lateral seismic design force or shear on elements of the isolation system or elements below the isolation system, as prescribed by Equation 9-8 9-27

V_{bjs} Expected shear strength of wall or pier based on bed-joint shear stress, lb 7-25

V_e Shear demand in the column caused by the drift 10-15

V_{CE} Expected shear strength of a member, kips 5-39

V_{CE} Nominal shear capacity, lb 7-25

V_{CE} Shear strength of a link beam, kips 5-39

V_{dt} Lower bound of shear strength based on diagonal tension for wall or pier, lb 7-25

V_{fre} Expected story shear strength of bare frame, lb 7-25

V_i The total calculated lateral shear force in story i due to earthquake response, assuming that the structure remains elastic 2-47

V_{ine} Expected shear strength of infill panel, lb 7-25

V_n Nominal shear capacity of the column 10-15

V_m Expected shear strength of reinforced wall or pier based on masonry, lb 7-25

v_{me} Expected masonry shear strength as determined per Equation 7-1, psi 7-25

V_r Expected shear strength of wall or pier based on rocking, lb 7-25

V_s Expected shear strength of wall or pier based on shear reinforcement, lb 7-25

v_s Shear wave velocity at low strain 4-21

v_s Shear wave velocity in soil, in feet/sec 2-47

$\bar{v}_s$ The average value of the soil shear wave velocity in the upper 100 feet of soil, calculated in accordance with Equation 2-6, feet/sec 2-47

V_s The total lateral seismic design force or shear on elements above the isolation system, as prescribed by Section 9.2.4.4B 9-27

V_t Total base shear determined by response history analysis 9-27

V_{tc} Lower bound of shear strength based on toe compressive stress for wall or pier, lb 7-25

v_{te} Average bed-joint shear strength, psi 7-25

V_{test} Measured force at first movement of a masonry unit with in-place shear test, lb 7-25

v_{to} Bed-joint shear stress from single test, psi 7-25

V_y Shear to element at yield 8-33

V_y Yield strength of the building in the direction under consideration, for use with the Nonlinear Static Procedure 3-17

V_{ya} Nominal shear strength of a member modified by the axial load magnitude, kips 5-39

W

w Length of flange angle 5-40

w Water content of soil, calculated as the ratio of the weight of water in a unit volume of soil to the weight of soil in the unit volume, expressed as percentage 2-47

W The total seismic dead load. For design of the isolation system, W is the total seismic dead load weight of the structure above the isolation interface 9-27

W Total dead load and anticipated live load 3-17

W_D Energy dissipated, in in.-k, in a building or element thereof during a full cycle of displacement 9-27

w_i and w_x Portion of the total building weight corresponding to floor levels i and x, respectively 3-18

W_i and W_x Weight of floors i and x, respectively 3-17

W_p Component operating weight 11-28

w_z Width of panel zone between column flanges, in. 5-40

ω_1 2πf1 9-28

X

x Distance from the diaphragm center line 3-18

x Elevation in structure of component relative to grade elevation 11-28

X Height of upper support attachment at level x as measured from grade 11-28

Y

y The distance, in ft (mm), between the center of rigidity of the isolation system rigidity and the element of interest, measured perpendicular to the direction of seismic loading under consideration 9-27

Y Height of lower support attachment at level y as measured from grade 11-28

Z

Z Plastic section modulus, in.3 5-39